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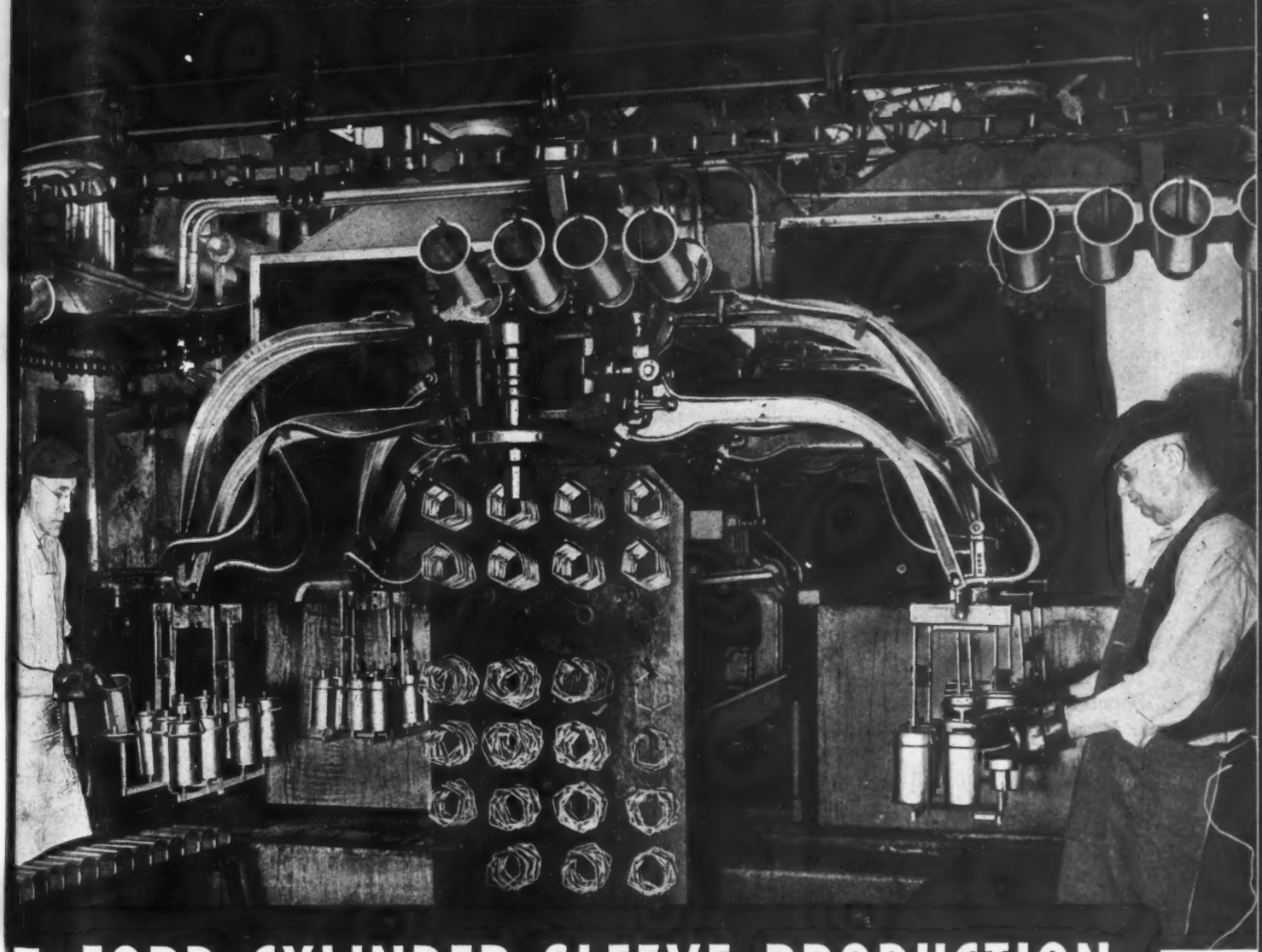

FORD CYLINDER SLEEVE PRODUCTION
Embodies Unique Engineering Ideas

By CHARLES O. HERB

CYLINDER sleeves made from sheet steel are used as liners in the engine blocks of Ford tractors, and are also used in servicing worn cylinders of Ford automobile engines. These sleeves are produced mainly from scrap fender material, new steel sheets being employed only as required to maintain adequate stock reserves of sleeves.

The sleeves are manufactured on a mass production basis in machine set-ups that incorporate a number of unique engineering ideas and reduce manual handling of work to a minimum. For example, the sleeves pass through a series of nine drawing operations, three trimming operations, six washing machines, three heat-treating furnaces, an automatic storing machine, and several flanging operations, all without being touched by human hands. There are two completely automatic machine lines for handling two different sizes of sleeves, and a third line, not arranged for continuous operation, which handles a limited quantity of a third size.

The automatic manufacturing lines were developed to their present state of perfection shortly before the entry of this country into the war, and

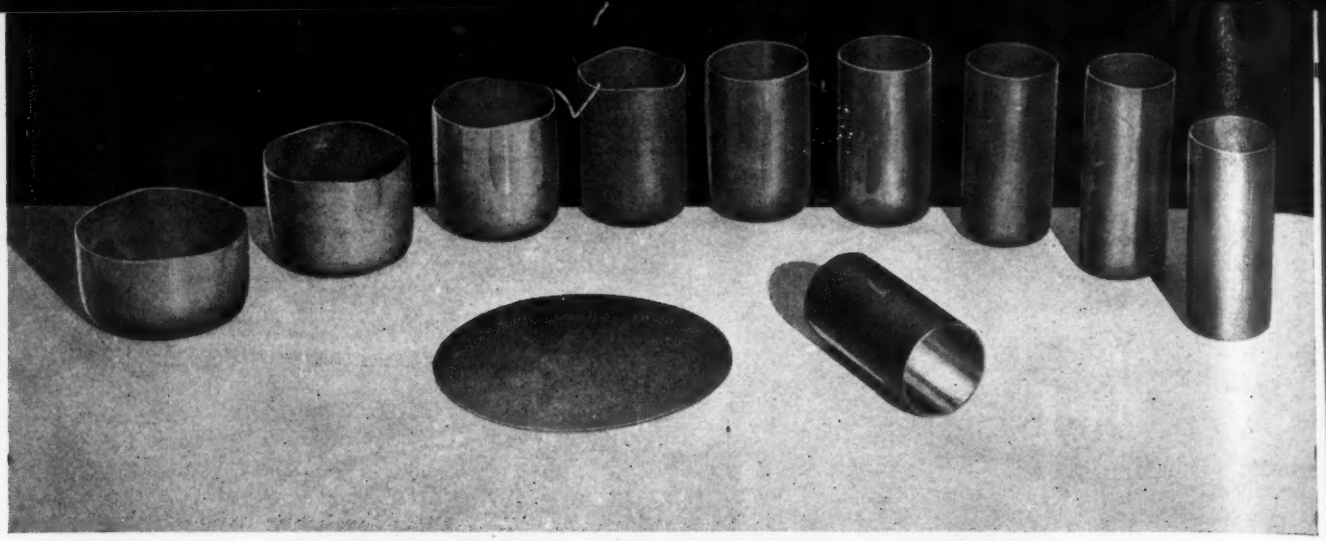

Fig. 1. Progressive Steps in the Drawing and Trimming of Cylinder Sleeves from Copper-plated Sheet Steel. The Disk from which the Sleeves are Drawn and a Completed Burnished and Honed Sleeve are Shown in the Foreground

after the temporary curtailment of operations, are again in full production. They have not heretofore been described in the technical press. The step-by-step procedure followed along one of the production lines, from the point where the blanks are received from the press shop to the final inspection bench, will be described in this article. This line is set up to turn out 5000 finished sleeves per eight-hour shift.

The blanks of 0.045-inch thick low-carbon, open-hearth, deep-drawing steel are in the form of disks 10 1/8 inches in diameter. Upon their arrival in the sleeve-making department, the disks are suspended on racks of a conveyor, as illustrated in Fig. 2, which carries them automatically through a copper-plating operation. Twelve disks are loaded on each rack. The loaded disks are immersed successively in a tank containing a caustic soda solution, a tank containing muriatic acid, and two cold-water rinse tanks, after which this procedure is repeated in order to insure thorough cleaning of the work. Then the disks are immersed for eighteen minutes in a long electroplating tank, where copper is deposited on them to a thickness of from 0.00015 to 0.00025 inch. Following the electroplating step, the disks are successively immersed in cold and hot water baths, and finally reach the unloading station seen in Fig. 2. Nine hundred and sixty disks are handled by the copper plating equipment at one time. The cycle of the operation is forty-three minutes.

The purpose of copper-plating is to facilitate the subsequent drawing operations. The copper acts as a lubricant, and enables the drawing steps to be performed with a minimum of annealing. Before this method was followed, difficulty was experienced through the sleeves hardening too much, scoring, tearing, and so on. No lubricant is used now in the drawing operations, except during the first step, when soluble oil is supplied copiously to the disk blank.

As the disks are removed from the copper-plat-

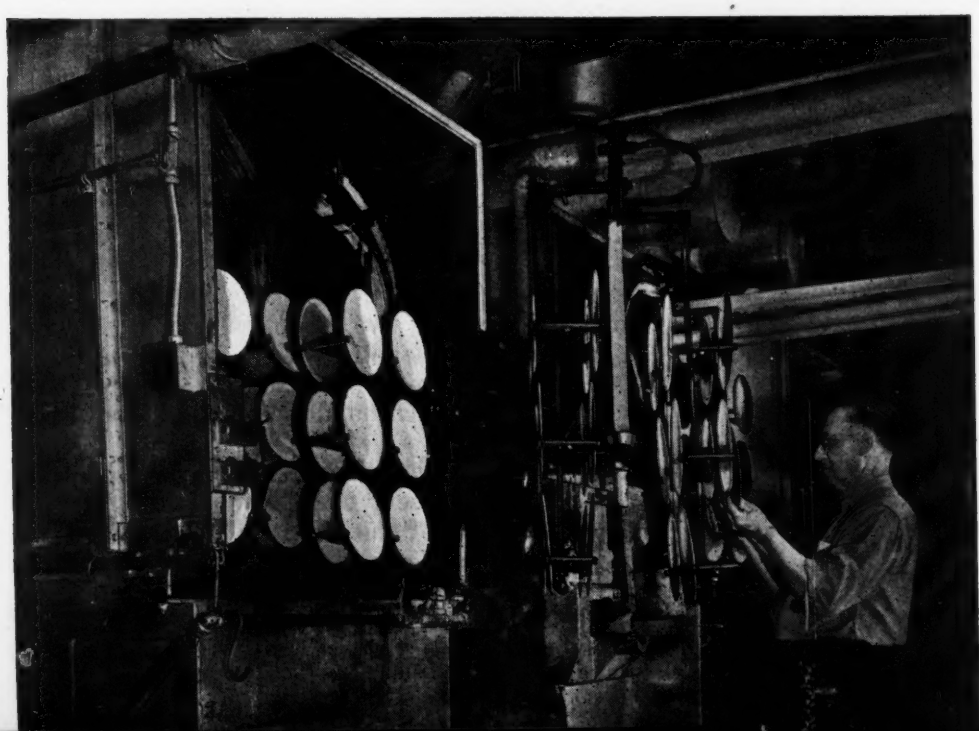

Fig. 2. The Steel Disks from which the Cylinder Sleeves are Produced are First Copper-plated to Permit Nine Drawing Operations on the Comparatively Light Metal with Minimum Heat-treatment

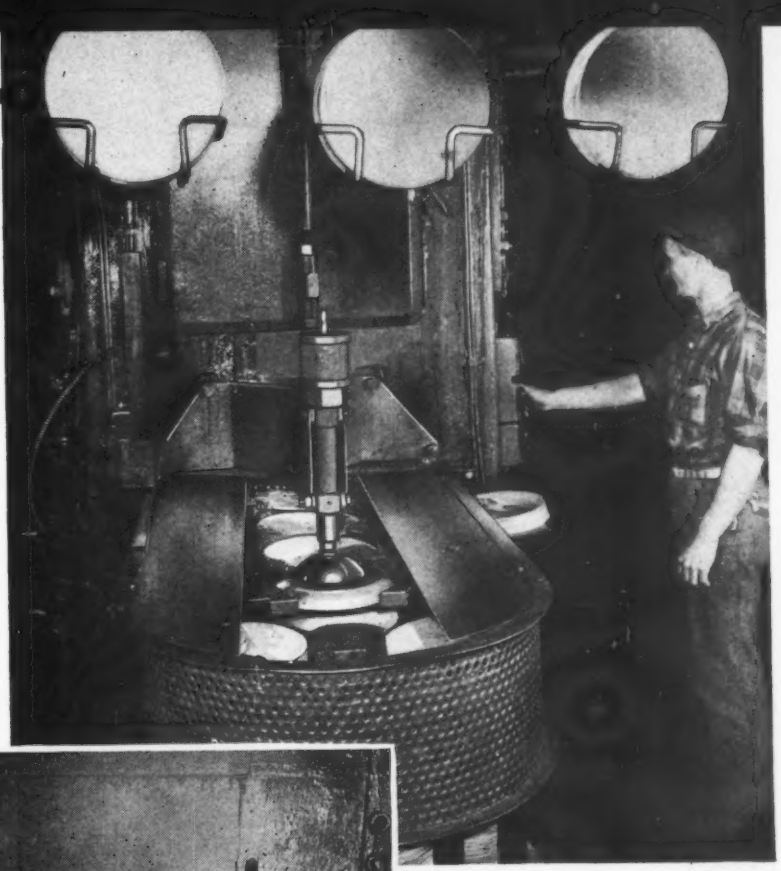

Fig. 3. (Right) The Copper-plated Disks are Automatically Fed into the First Press in the Production Line by the Use of an Arm Equipped with a Rubber Suction Cup and Mechanically Operated Slides

Fig. 4. (Left) The First Press in the Production Line is Equipped with a Three-station Progressive Die which Draws the Disk Blanks Successively to the Three Shapes Seen at the Left in Fig. 1

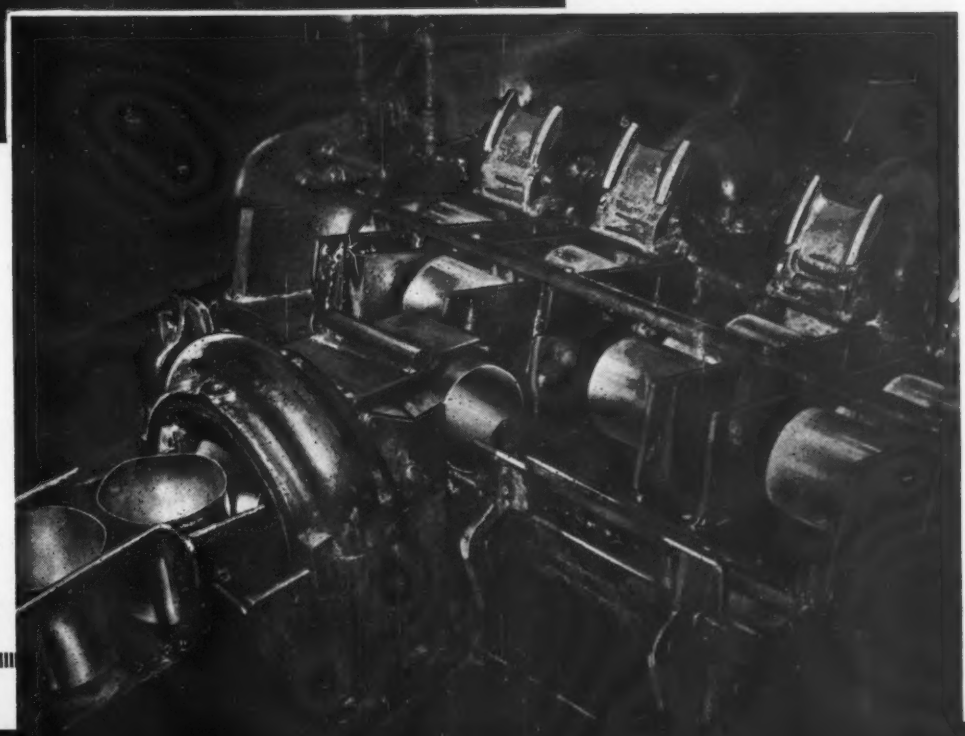

Fig. 5. (Right) Ingenious Means have been Provided to Transfer the Drawn Cups from the Press in Fig. 4 to and through the Washing Machine Seen at the Right in This Illustration

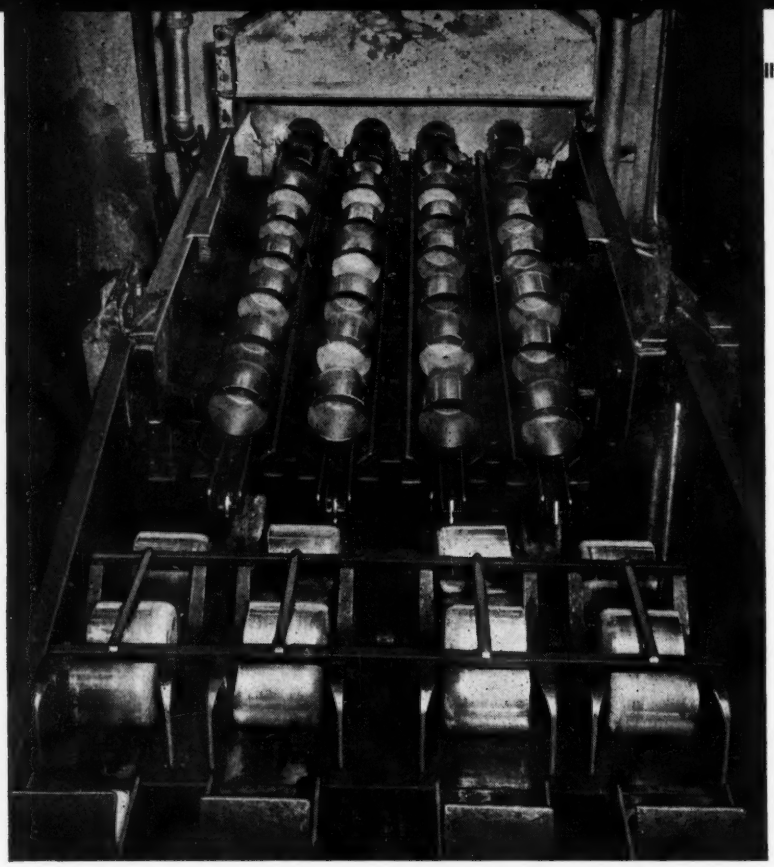

Fig. 6. (Left) From the Washing Machine the Thoroughly Cleansed Cups are Transferred Automatically to a Bright Annealing Furnace which Softens Them for Subsequent Drawing Operations

Fig. 7. (Below) The Press Here Illustrated Performs the Fourth, Fifth, and Sixth Draws on the Cups and Trims the Open End by Means of a Cam-actuated Shimmy Die

ing conveyor, they are stacked in piles about 3 feet high, and these piles are transferred to a hand-indexed table at the end of the press that performs the first series of drawing operations. This table is seen in Fig. 3. With each stroke of the press, a rubber suction cup attached to the lower end of a vertical arm is brought down on top of one stack. The cup lifts a disk from the top of the pile to a height even with curved jaws attached to two slides which are arranged to feed the disks successively to the progressive dies of the press. These jaws are open when they come into line with the lifted disk and are automatically closed on the disk, as seen in the illustration, preparatory to advancing the disk one step toward the press. As the jaws are closed, a small finger presses on the edge of the rubber cup, with the result that sufficient air is admitted under the cup to break the suction and to release the disk.

As soon as the jaws have closed, the slides move back toward the press a distance slightly greater than the diameter of the disks, which corresponds to one-half the distance between the punches of the progressive die on the press. At this point, the jaws

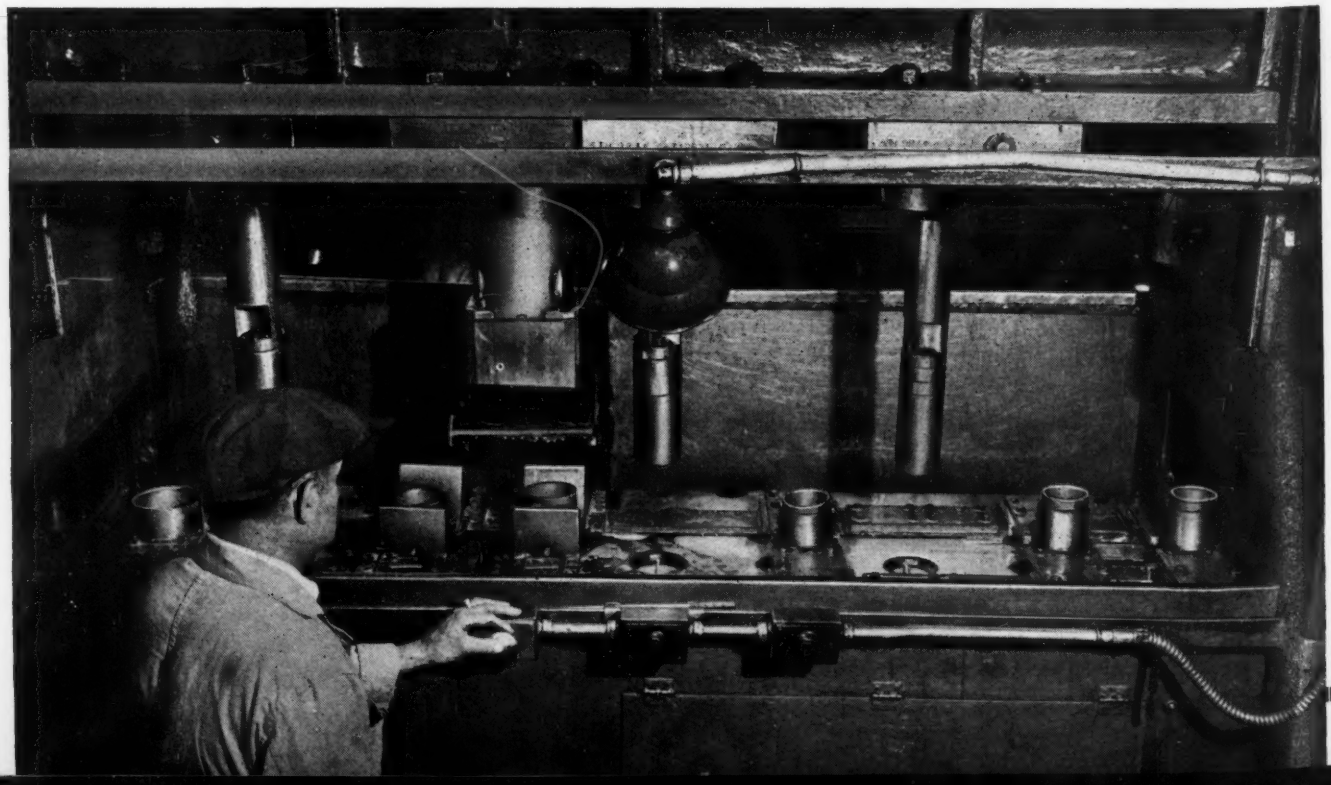

Fig. 8. (Right) A Machine of Unique Design in the Production Line, which Controls the Delivery of Sleeves to the Final Drawing Press. This Machine has a Capacity for Storing 2400 Sleeves

Fig. 9. (Below) Dies Provided on a Mechanically Operated Press for Performing Ninth Draw, Trimming the Cups Top and Bottom, and Bending a Flange on One End

open up and the slides bring the first pair of jaws forward into line with the next disk to be lifted by the suction cup. There is a series of jaws on the slides, as will be seen in the illustration, so that as the first pair of jaws closes on a disk held by the suction cup, the jaws further along the line close on disks that have been progressively advanced toward the press. At the moment when the disks are not in motion and the jaws are shifting their positions, the press ram is in action.

As the pile of disks diminishes, the operator raises the stock intermittently through a foot-pedal jack to within the range of the suction cup. When one pile has been used up, the operator merely indexes the table a quarter of a turn to bring another pile under the lifting arm.

Three drawing operations are performed by the Cleveland press shown in Fig. 4, which is the first machine in the completely automatic line. In the first step, which is actually a cupping operation, the disk is formed to the shape seen at the extreme left in Fig. 1; following this operation, the part has an inside diameter of 5.914 inches and a length of approximately 3 1/2 inches. In the second step, the

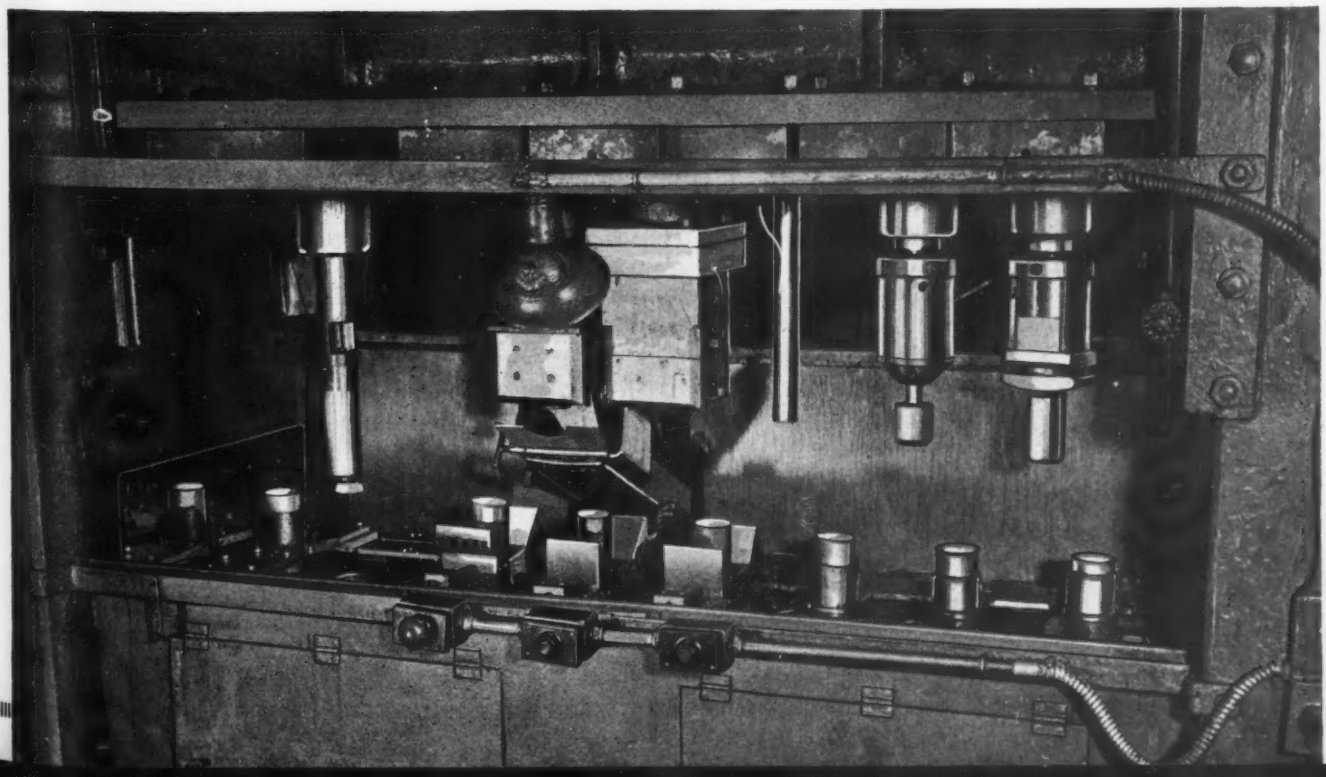

Fig. 10. The Cylinder Sleeves are Burnished Internally before Hardening, so as to Facilitate Final Finishing of the Inside Surface

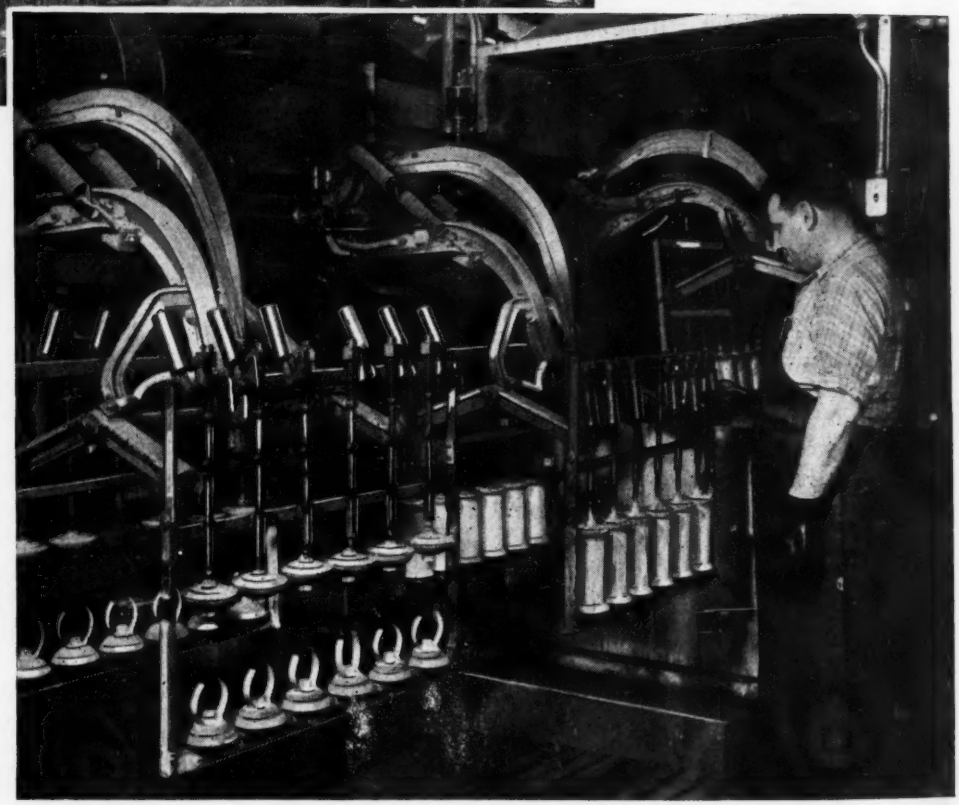

Fig. 11. In Order to Prevent the Outside Surface of the Sleeves from Hardening during the Final Heat-treating Process, the Sleeves are Coated Externally with Tin

cup is drawn to an inside diameter of 5.167 inches and a length of about 4 1/4 inches, and in the third step it is drawn to an inside diameter of 4.539 inches and a length of 4 7/8 inches.

In each instance, the cup is forced down through the die. There it is picked up by jaws on another pair of work-transfer slides in the bed of the press. These jaws pick up the cup as it falls through the first die and transfer it to a point half way between the first and second dies. Here there is an opening in the die-block. A mechanism in the bed of the press rises and pushes the cup through this opening to a height where it can again be gripped by jaws on the upper work-transfer slides. Then, with the next longitudinal movement of the upper work-transfer slides, the cup is carried into position beneath the second punch.

The second punch, in turn, pushes the cup through the die upon the next descent of the ram. The cup is then transferred into position beneath the third punch by a procedure similar to that followed in conveying it from the first to the second punch. After the third punch has pushed the cup through the die, it is raised by the transfer mechanism to an opening at the right of the third die, from which it is carried out of the press by the transfer slides. In Fig. 4, the cups at each station are seen being raised through the die-block by the raising mechanism in the press bed, into line with the transfer slides. The guards that normally close the front of the press were removed at the time the photograph was taken to permit an unobstructed view of the punches and die.

When the cups are pushed from the press, they

progress along the chute seen at the left in Fig. 5 and pass through a swiveling device which turns the cups into a horizontal position, ready for passage through a washing machine. This washing machine is arranged with four work-chutes, as seen in the illustration. An arm which moves back and forth between V-ways, arranged transversely across the washing machine, automatically positions the drawn cups into line with the washing machine chutes. In this way, the chutes are kept uniformly loaded. The guard ordinarily provided in front of these chutes and the swiveling device was removed, in this case also, when the photograph was taken to show the mechanism.

The washing machine is of a unique design which enables the cups to be kept immersed in water for an unusual length of time, considering the short length of the washer. It is constructed with a series of U-shaped channels down which the cups are pushed by rocking levers, such as seen at the extreme right. The pressure exerted on the cups pushes them down around the "U" of the channels and up the other side. The cups then roll into contact with other rocking levers and are again pushed down into the water through U-shaped channels. This is repeated five times, after which the cups reach the chutes seen in Fig. 6, ready for the first bright annealing operation.

As the tanks of the washing machine are about 2 feet deep, the cups actually travel a distance of approximately 26 feet in water during their passage through the washer, in spite of the fact that the machine is only 9 1/2 feet long. When the cups leave the washer they have been thoroughly

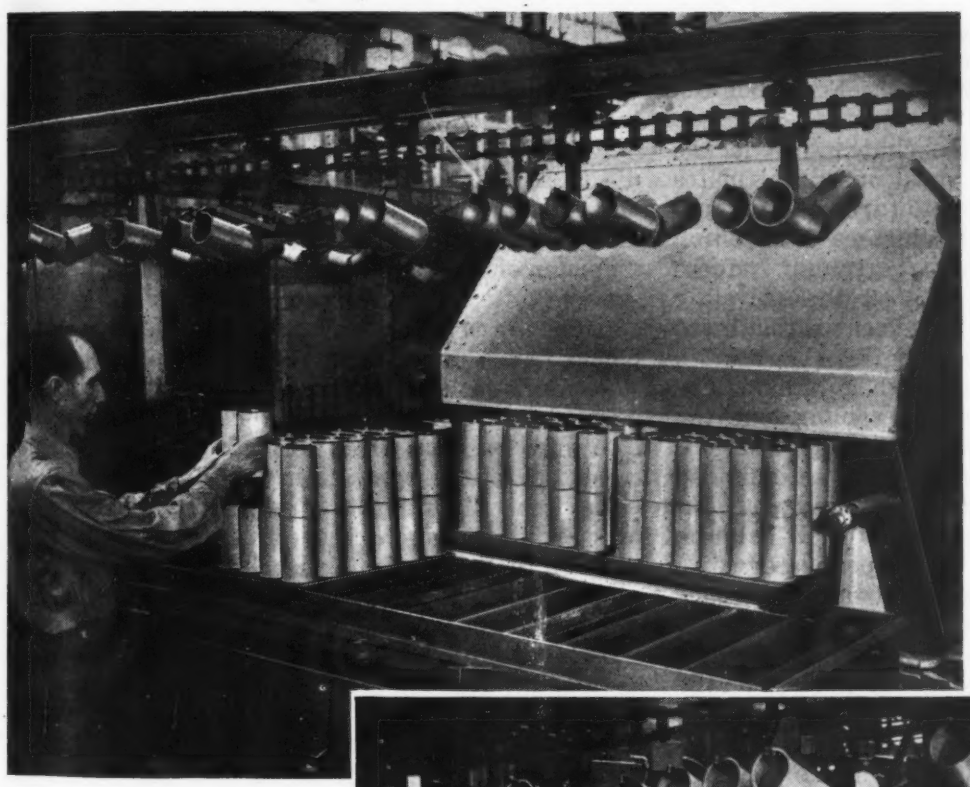

Fig. 12. Loading the Tinned Cylinder Sleeves into a "Carbo-nitriding" Furnace which has a Capacity for Almost Four Thousand Sleeves

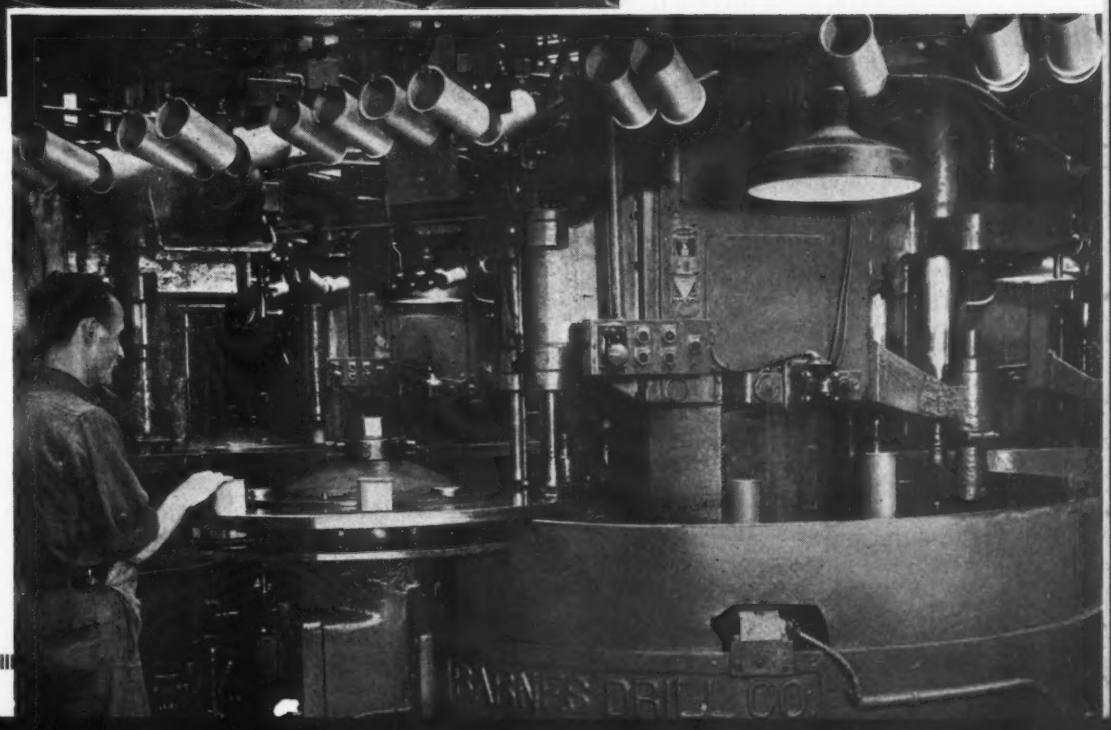

Fig. 13. Burnishing and Honing Machine that Finishes the Inside of the Cylinder Sleeves to the Specified Size within a Tolerance of 0.0002 Inch. A Special Loading Table is Seen at the Left

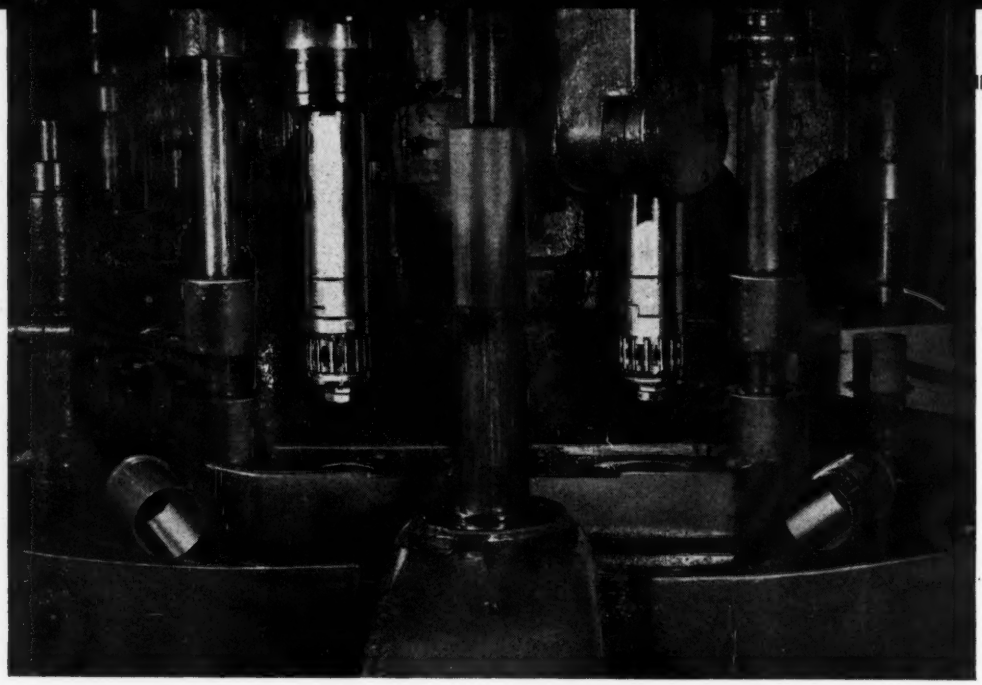

Fig. 14. Close-up View of the Two Burnishing Spindles on Machine in Fig. 13, Showing the Construction of the Burnishing Tools

cleansed of all grease and dirt. This washing machine and similar installations in the cylinder sleeve department were built in the Ford tool and die shop.

When the cups roll off the chutes seen in the foreground of Fig. 6, they drop on swivel plates that revolve on a vertical axis to turn the cups into line with the push-bars of the Surface Combustion annealing furnace seen in the background. Latches on the push-bars pick the cups off the swiveling devices for their automatic movement through the furnace.

The furnace is constructed with a radiant-tube heating zone and a water-jacketed cooling zone, the heating zone being operated at a temperature of between 1560 and 1650 degrees F. Controlled atmosphere, from which all impurities have been removed, is delivered to the furnace by D-X units, insuring a bright anneal of the copper-plated cups. Consequently, the sleeves come out of the furnace just as clean as when they go in. They are in the furnace for twenty minutes. When the cups enter the furnace, they have a hardness of 75 to 79 on the Rockwell B scale, and when they leave, their hardness is between 45 and 50 Rockwell B.

Following the annealing operation, the cups are automatically fed through a second washing machine, of the same type as the one described, in which a caustic washing solution is provided in all four compartments. Then, they are automatically fed to the Clearing press shown in Fig. 7, which is equipped with a progressive die set for the performance of three drawing operations and a trimming operation.

In the first operation, which consists of the fourth draw, the inside diameter of the cups is reduced to 3.918 inches and the length is increased to approximately 5 1/2 inches. In the second die position, a cam-operated shimmy die trims the open end to a length of 5 inches. Moving members in the shimmy die, operating in four directions, completely trim off the excess stock, which slides down a chute to the rear of the press. A plug on the upper member of the shimmy die supports the cup internally while the scrap is being cut off.

Each cup is transferred direct from the shimmy die to the fifth draw punch without being forced down through the die-block, as in the case of the drawing operations. In the fifth draw, the inside diameter of the cup is reduced to 3.666 inches and the length is increased to 5 5/8 inches. When the cups leave the sixth draw die, they measure 3.418 inches inside diameter and 6 1/8 inches in length. The transfer of the cups through this press is effected by means of upper and lower slides, and again the cups are lifted through the die-block between operations by a mechanism in the bed.

Equipment similar to that shown in Fig. 5 is provided to the right of this press to carry the cups through the next washing machine, which is of the same type as those already referred to. The five compartments of this machine are supplied with a caustic washing solution. By this time, the cups have again attained a hardness of between 75 and 79 Rockwell B as a result of the various drawing steps and must be annealed a second time. A furnace similar to that already mentioned, which is also operated at a temperature of between 1560 and 1650 degrees F., is employed for this purpose, the cups being fed from the washing machine to and through the furnace without being touched by hand. When the cups leave this furnace, the hardness is reduced to between 45 and 50 on the Rockwell B scale.

After this bright anneal, the cups pass through a fourth washing machine of the same type as the preceding ones. Then they arrive at a Cleveland press used for performing the seventh and eighth drawing operations. The seventh draw reduces the inside diameter of the cups to 3.248 inches and increases the length to 6 5/8 inches, and after the cups leave the eighth draw they have an inside

diameter of 3.078 inches and a length of 7 1/8 inches. Next the cups are fed progressively through a fifth washing machine, a bright annealing furnace, and a sixth washing machine.

The machine to which the cups are now carried is of unique construction, devised to automatically store the cups if they arrive too quickly to be handled by the next press and to release them in accordance with the production of this press. A partial view of this machine is shown in Fig. 8. The cups are fed through the storage machine in four rows as they come from the preceding washing operation, and are fed up vertical troughs if the chutes that lead to the press are filled up, as shown in the foreground. There are twenty-two rows of four vertical troughs, which provide capacity for storing as many as 2400 cups at one time. This machine has eliminated the clogging of the aisles with racks and the loading and unloading of the racks by hand as the cups are required by the press. The machine constitutes a safety valve for mass production.

The Clearing press which is fed from this storage machine is employed for the final draw and trimming and flanging operations on the cups. The ninth draw is performed by the punch seen at the extreme left in Fig. 9 which draws the cups to an inside diameter of 3.050 inches and a length of 7 3/8 inches. The punch forces the cups through the die, and they are then transferred to a shimmy die in the second position by means of upper and lower slides of the type employed on the first press of this production line.

The second operation on the press shown in Fig. 9 consists of trimming the open end by employing a shimmy die of the same general construction as the one already referred to. Then the cups pass to a third shimmy die, which cuts off the closed end, transforming the cups into straight tubes, or sleeves, 6 11/16 inches in length. The sleeves are next transferred to the third position on the press where a punch comes down and bends a 45-degree flange on the upper open end. In the fourth position, this flange is bent down to an angle of 90 degrees relative to the side wall. The flange is about 3/16 inch wide.

The flanged sleeves discharged from this press roll along the gravity conveyor seen at the left in the heading illustration, from which they are taken by hand—the first time that the work-pieces have been touched by human hands since the disks were fed into the press that performs the first three drawing operations. When the sleeves are taken from the gravity conveyor, they are loaded on the racks of an automatic conveyor which carries them through copper stripping baths in a process that is approximately the reverse of the electrolytic plating bath at the beginning of the production line. The plain steel sleeves return on the right-hand side of the unit to the station seen in the heading illustration, where they are removed from their racks and placed on an overhead conveyor that carries them to Barnes machines of the type shown in Fig. 10.

These machines are employed for burnishing the inside of the cylinder sleeves. Two men each load two sleeves at a time in the front and left-hand stations of the machine, inserting the sleeves partially in bushings in the automatically indexed table. When the heads of the machine come down, plungers at these two stations seat the sleeves fully in the bushings. Then when the heads again ascend, the table indexes 180 degrees to position the loaded sleeves between burnishing tools attached to heads on opposite sides of the machine. Loading and burnishing, of course, are performed simultaneously on different sleeves.

Burnishing tools of the type shown in Fig. 14 are used in this operation, although the particular

(Concluded on page 157)

Fig. 15. One of the Inspection Tables where the Completed Sleeves are Carefully Checked for Dimensional Accuracy and for Surface Appearance

Machining Stainless-Steel Va

Recommended Practices and Tools for Turning, Drilling, and Threading Stainless-Steel Parts, and the Coolant Employed in Machining Operations

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Linden, N. J.

CORROSION resistance, prevention of product contamination, mechanical strength, durability, and good appearance are properties that have made stainless-steel valves and fittings valuable to many industries. Because of these qualities, they are widely used by the chemical, process, and food industries.

The following recommendations for machining stainless-steel alloys, which cover the practice of the Alloy Steel Products Co., pertain to the three alloys listed in the accompanying table and similar high-chromium, high-nickel, and low-carbon content stainless-steel alloys. All of these alloys are austenitic, having a crystalline-pattern structure, and are non-magnetic. They cannot be hardened by heat-treatment, but they are work-hardening.

Some modifications of conventional methods of machining are required with stainless steels because of their unusual chemical and physical properties. High tensile strength, yield strength, and hardness contribute to the need for these modifications. However, the inherent characteristic of work-hardening is the main reason for the special care and close control necessary in machining these alloys.

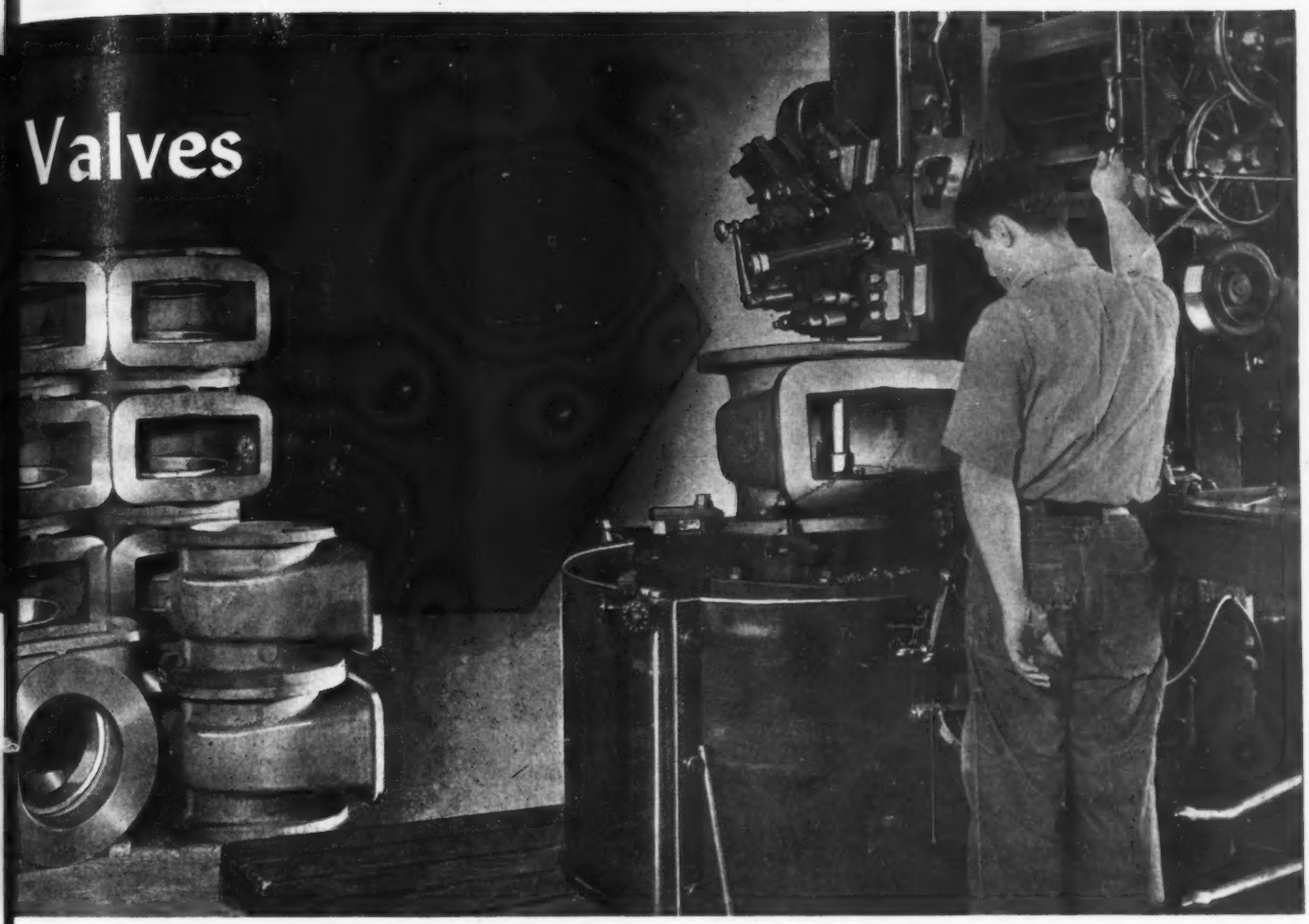
The tool, in passing over the work, will harden the surface and thus make the next cut more difficult. Milling and drilling operations, where fine cuts follow each other in rapid succession, are particularly troublesome because of work-hardening. As roughing cuts create a hard skin, only one cut is made whenever possible. This tough skin is constantly ahead of the point of the twist drill and ahead of the turning tool in the direction of feed.

The only way of overcoming this difficulty is to use slower speeds and heavier cuts than are ordinarily used on carbon steels and to employ continuous uninterrupted cutting. The latter

Chemical Composition and Physical Properties of Three Types of Stainless Steel

Chemical Constituents and Physical Properties	"Aloyco" 18-8S	A.I.S.I. Type 304	"Aloyco" 18-8SMO	A.I.S.I. Type 317	"Aloyco" 20*
Chromium, Per Cent	18 to 20		18 to 20		19 to 21
Nickel, Per Cent	8 to 10		9 to 12		28 to 30
Molybdenum, Per Cent	.....		2.75 to 3.25		2.5 to 3.0
Manganese, Per Cent	0.65 to 0.85		0.65 to 0.85		0.65 to 0.85
Silicon, Per Cent	1.0 to 1.5		1.0 to 1.5		0.75 to 1.25
Carbon, Per Cent	0.07 Max.		0.07 Max.		0.07 Max.
Copper, Per Cent	.....		.....		4 to 4.5
Iron, Per Cent	Balance		Balance		Balance
Tensile Strength, Pounds per Square Inch	70,000		72,000		75,000
Yield Point, Pounds per Square Inch	32,000		35,000		35,000
Elongation, Per Cent in 2 Inches	45		45		45
Reduction of Area, Per Cent	50		50		50
Hardness, Brinell	150		160		150
Melting Point, Degrees F.	2550		2520		2650

*"Aloyco" 20 is a special alloy containing less than 50 per cent iron; accordingly, there is no A.I.S.I. type that conforms with it.



method is important; if the tool is allowed to slip or idle in the cut, glazing and hardening of the work will result, making additional cutting more difficult. This would increase the danger of tool breakage or work spoilage, or both. When more than one cut is required, the subsequent cuts should be heavy enough to remove the work-hardened skin left by the preceding cut.

Special machines or over-size motors are not used in machining stainless-steel alloys. However, by employing two-speed motors and rotating the spindle at approximately two-thirds the speeds ordinarily employed for mild steels, more power is available. It is estimated that 50 per cent more power is required to remove a certain amount of stainless steel than to remove the same amount of mild carbon steel. Rigidity and good mechanical condition are essential in machines used on these alloys. Steady power supply and transmission at the low speeds used are also necessary.

The chips formed in machining stainless-steel alloys are harder than the cut surface, and care must be exercised in guiding the chips to prevent them from scratching the surface of the work. A successful chip-breaker has not been developed for the tools used in cutting these alloys.

High-speed steel, carbide, and cast-alloy tools have been used successfully on alloys of the types being discussed, and will be dealt with under specific machining operations. Carbide and cast-alloy tools permit an increase in working speed of approximately twice that used with high-speed steel tools, provided the machine, tool, and work are sufficiently rigid and the power is adequate.

Turning Stainless Steel on Turret Lathes

A surface speed of from 55 to 85 feet per minute has been found satisfactory for turning on turret lathes, depending upon the alloy being machined. Box-tools, however, are limited to a speed of 35 to 40 feet per minute because of the excessive frictional heat created by work, tool, and rolls at higher speeds. Feeds vary from 0.002 to 0.10 inch per revolution, and are dependent upon the size of the work being turned, the capacity of the machine tool, and the depth of cut. To obtain the best surface finish, a finish cut is sometimes made at feeds of 0.001 to 0.005 inch per revolution, with from 0.005 to 0.150 inch depth of cut.

Warner & Swasey turret lathes are used for turning wrought stock and small castings, and Bullard vertical turret lathes for large castings at Alloy Steel Products Co. Bar stock is used wherever practical for internal trim, and castings for bodies, bonnets, and trim on larger size valves.

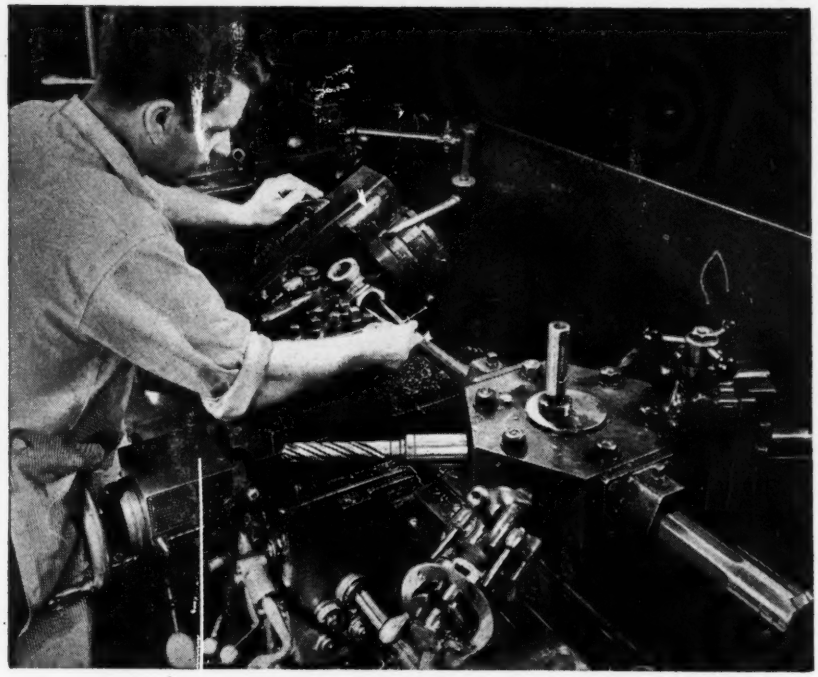


Fig. 1. The Body of a 2-inch Stainless-steel Globe Valve is Mounted in a Two-jaw Indexing Chuck on a Turret Lathe for Machining Surfaces in Different Planes

The body of a 2-inch globe valve is in position for boring on the turret lathe shown in Fig. 1. This operation is performed at a speed of 75 surface feet per minute, with a feed of 0.006 inch per revolution and a depth of cut varying from 0.062 to 0.093 inch. Special two-jaw indexing chucks, one of which is shown on the turret lathe, are used for the majority of the castings turned on turret lathes. This type of chuck saves considerable time on work where similar surfaces must be machined in different planes. After completely machining one bore and face, the valve body can be quickly indexed through 90 degrees to machine the second bore and face, and then indexed 180 degrees to machine the third pair of surfaces, all without disturbing the clamping or alignment of the work with the tools.

One of the flanges of a 6-inch Y-valve body is shown being faced on a vertical turret lathe in Fig. 2. This operation is performed with the work rotating at a surface speed of 70 feet per minute, using a feed of 0.081 inch per revolution and a depth of cut of 0.006 inch. This continuous, spiral cut is made by feeding the tool from the outer edge of the flange toward the center of the valve body.

In Fig. 3, the seat of a 16-inch gate valve body is being turned at a surface speed of 65 feet per minute, with a feed of 0.0035 inch per revolution on a Bullard vertical turret lathe. The depth of cut for this operation is 0.012 inch.

As previously mentioned, it is advantageous to make continuous cuts on stainless steel wherever possible. This can be done on valve bodies having circular flanges, but those having rectangular flanges, such as the ones shown at the left in the heading illustration require interrupted cuts.

Tipped tools and tool bits made from Carboloy Grade 78B are used for continuous cuts on these alloys. For interrupted, or non-continuous, "skipping" cuts, such as are required on the rectangular flanges of valve bodies, brazed tipped tools and tool bits made of Rexalloy are used. Rexalloy is a cast, non-ferrous cutting alloy containing approximately 33 per cent chromium, 44 per cent cobalt, and 17 per cent tungsten, having a hardness of about 61 Rockwell C. These tools are provided with a copper cushion to increase their shock-resisting qualities and capacity for carrying the heavier loads encountered on tough "jump-cut" work without damaging the cutting edge of the tool.

Single-point sintered-carbide and cast-alloy turning tools are ground with a slight negative back rake, a side rake of approximately 5 degrees, side and end reliefs of about 5 degrees, and a slight nose radius. Stoning of the cutting edge with a hand hone after grinding is important to prevent chipping.

Internal boring-bars should be short and rigid. The largest diameter boring-bar that will not interfere with chip disposal is used. When long, slender boring-bars are necessary, they are piloted in a bushing which is mounted in the headstock of the machine.

Form tools are made from Rex AAA cast alloy. Forming operations are performed at a speed of 35 to 40 surface feet per minute. The form tools are provided with a 3 to 5 degree side clearance wherever practicable. The extra metal left on the work by the use of such side clearances on the form tools, is removed in a subsequent operation by a shaving or combination shaving and cut-off tool.

Drilling Operations and Twist Drills Used

Rigid set-ups and short twist drills are important factors in drilling stainless-steel alloys. Twist drills made by the Union Twist Drill Co. from high-speed steel containing 18 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium are used. The flutes of such twist drills are polished and the cutting edges are kept sharp. The standard 118-degree included angle of the cutting edges and a helix of 30 degrees are used on most drills. On work requiring small drills, say, 3/16 inch in diameter or less, it is extremely important to use the shortest drill possible in order to prevent springing. Standard length drills of small diameter are often cut off to obtain the minimum length required. On these smaller drills, and in drilling shallow holes, or where excessive drill breakage caused by torque is encountered, it is advantageous to flatten the cutting edges of the drill by increasing the standard included angle to approximately 130 degrees. A 12-degree angle of clearance back of the cutting edge has been found satisfactory for all size drills. A web thickness of about one-eighth the diameter of the drill is used. For example, the web of a 3/4-inch diameter twist drill is thinned to 0.097 inch.

Drilling speeds for stainless steels are approximately half those used in drilling mild steel with high-speed steel twist drills. Surface speeds of from 55 to 85 feet per minute, with feeds of 0.002 to 0.008 inch per revolution, depending upon the alloy being drilled, are suitable.

The operation illustrated in Fig. 4 consists of drilling eight 3/4-inch diameter bolt-holes simultaneously in the flange of a 4-inch gate valve. This operation is performed at a speed of 65 surface feet per minute, with a feed of 0.0065 inch per revolution. A 1-inch diameter hole is drilled in the flange of a 4-inch, 300-pound gate valve body on a radial drill at a speed of 60 surface feet per minute with a feed of 0.006 inch per revolution.

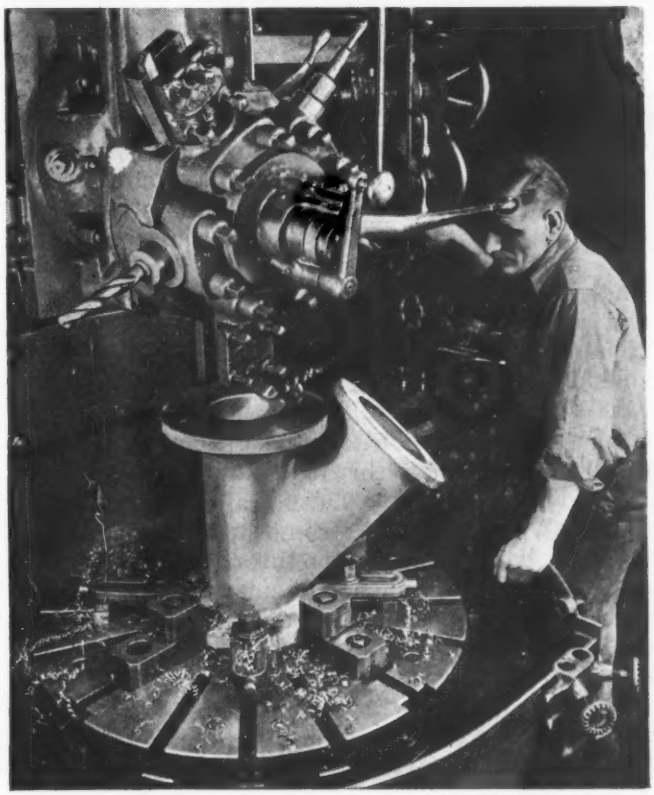
The feed must be constant and great enough to prevent dwelling of the drill, with consequent work-hardening. Hydraulic-feed drilling machines, such as the Natco multiple-spindle machine shown in Fig. 4, have proved very satisfactory in drilling stainless steels. Cutting oil is used in all drilling operations to prevent welding of the chips to the cutting lip and packing of the chips in the flutes.

In laying out these alloys for drilling, care must be exercised not to center-punch the holes too hard or work-hardening will result and it will be difficult to start the drill. Triangle-nose center-punches are preferred. Burrs on the work and burning of the drill tip resulting from an unclean breakthrough of the drill may be eliminated by backing up the work with a cast-iron or mild-steel plate while drilling, thus permitting the drill to cut all the way through the work without pushing the steel ahead of the drill point. Hydraulic feed of the drilling machine also assists in giving cleaner breakthroughs of the drill by eliminating the backlash that may be encountered with gear driven feeds. The flanges of drill-jig bushings are kept as thin as possible, so as not to increase the length of the drill required.

Tapping and Threading of Stainless Steels are Difficult

Ground-thread, hooked-face, high-speed steel solid taps and Landis receding-chaser collapsible taps are used for machining the Acme and tapered pipe threads on stainless-steel valves and fittings. Internal threading is one of the most difficult operations on these alloys, and on certain Acme threads it is necessary to employ a series of five separate taps. The minimum size standard pipe thread for which the receding chaser collapsible taps can be used is 1 1/4 inches. The receding action of the chasers as the tap enters the work reduces the high cutting strains involved in producing a tapered thread to the comparatively low torque required in producing a straight thread, thus resulting in greater accuracy and longer tool life. The use of a collapsible tap saves time, reduces wear of the

Fig. 2. The Flange of a 6-inch Y-valve Body is Turned at 70 Surface Feet per Minute on a Vertical Turret Lathe



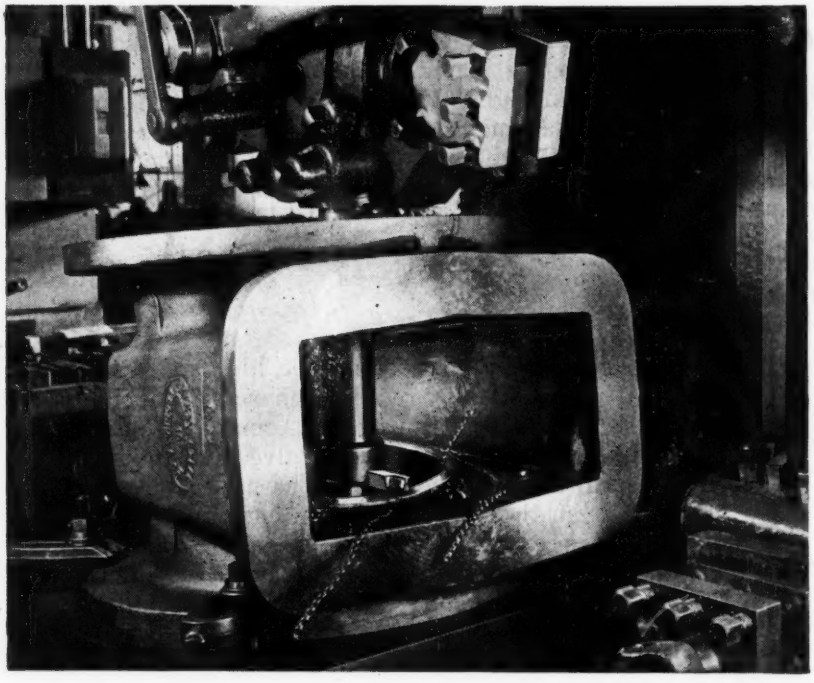


Fig. 3. Machining the Seat of a 16-inch Gate Valve Body at a Surface Speed of 65 Feet per Minute, with a Feed of 0.0035 Inch per Revolution on a Vertical Turret Lathe

chasers, prevents any additional work-hardening, and excludes the possibility of torn threads. Scrap due to unsatisfactory threads has been reduced to one-half of 1 per cent.

Tap drills are kept sharp in order to minimize work-hardening. Threads in stainless-steel alloys tend to swell, and a tap drill one size larger than ordinarily used for mild steels is recommended. Threads are finished in one operation in practically all cases to avoid work-hardening from a rough thread, which would make finish-threading too difficult.

Tapping of stainless steels must be done at speeds lower than those employed on most other steels, and a maximum of 15 surface feet per minute has been determined best for maximum tap life. It is desirable, in threading stainless steel, to restrict the percentage of thread to a minimum, but it is necessary on the majority of valves and fittings to provide 95 per cent full pipe thread. Solid and collapsible taps are ground with a hook angle of approximately 15 degrees. This hook grind should include the first full tooth. A slight negative rake and small back clearance are also desirable. Chasers for collapsible taps are ground with a hook of 50 degrees and a throat of 30 degrees.

Solid taps with two flutes, called "chip-driver" or "gun" taps, are the strongest, and throw chips forward, being designed for through holes. A three-flute tap has less tendency to cut over size, but provides less chip clearance. Four-flute taps are generally used for threading large-diameter and deep holes.

The life of taps in threading these alloys is relatively short, averaging approximately 550 threaded holes per tap. Very little reclamation of taps is possible because a broken tooth usually becomes embedded in the work, stripping the rest of the tap and making resharpening impossible.

Valve stems are threaded with double left-hand and single right-hand Acme threads up to 1 3/8 inches in diameter by means of Landmatic die-heads mounted on turret lathes. These operations are performed at a cutting speed of from 10 to 15 surface feet per minute, depending upon the chaser throat and the pitch of the thread. The throat angle of the chaser is ground to 12 degrees for single threads and 10 degrees for double Acme threads. A chaser rake angle of from 22 to 25 degrees is used.

Tapered pipe threads are made with alternating-tooth chasers, which are patented by the Landis Machine Co. In regular tooth pipe chasers, both sides of the teeth have cutting action. With the drop tooth type of chaser, both sides of the teeth have cutting action, but every other tooth is omitted. However, with the alternating-tooth chaser, in addition to every other tooth being omitted, the teeth have cutting action on only one side and the other side of each tooth is relieved. This form of chaser prevents tearing the crest of the thread and makes possible the production of smooth finished pipe threads on stainless steel.

A 4-inch Landmatic taper-attachment die-head, mounted on a threading machine, is used to produce many of the pipe threads. Chasers for this taper-attachment die-head are ground with a 25-degree rake angle, and with a lead angle of 91 degrees for 1/4- to 3/4-inch pipe threads, and 92 degrees for 1- to 2-inch pipe threads. The cutting edge is hooked back 1 3/4 degrees for 1/4- to 3/4-inch pipe threads, and 1 degree for 1- to 2-inch

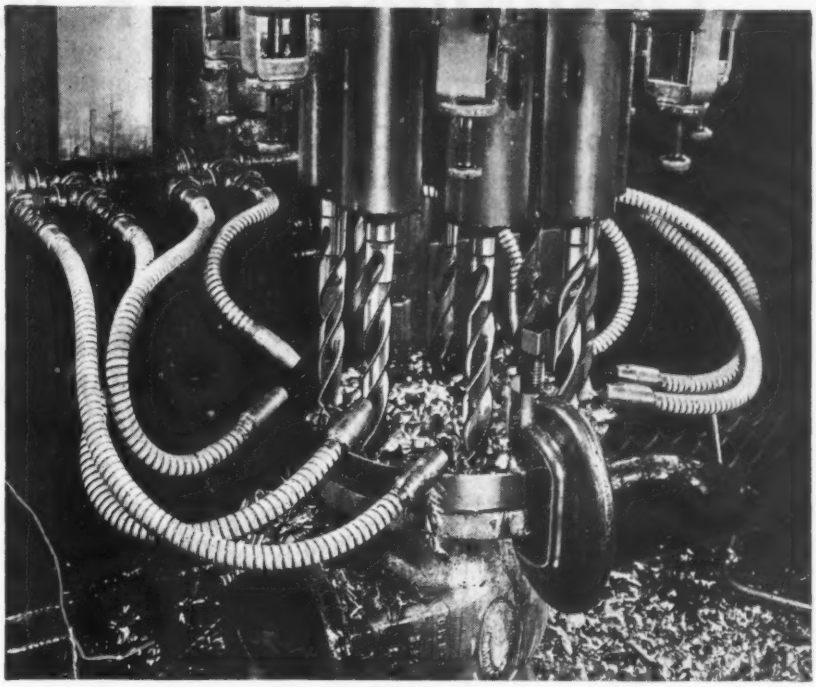


Fig. 4. Drilling Eight 3/4-inch Diameter Holes in the Flange of a 4-inch Gate Valve Body at a Speed of 65 Surface Feet per Minute, with a Feed of 0.0065 Inch per Revolution

pipe threads. Chasers for regular Landmatic dieheads, which are used with the lead-screw attachment on turret lathes, are also ground with a 25-degree rake angle, but the lead angle for 1/4- to 3/4-inch pipe threads is only 88 1/4 degrees, and for 1- to 2-inch pipe threads 89 degrees.

Proper Cutting Oil is Important Factor in Machining Stainless Steel

A specially developed, dark colored, extreme-pressure, sulphurized oil is used for all machining operations. The sulphur content of this oil is active, and an extreme-pressure agent has been added which gives the high-load carrying ability necessary in machining stainless steel. This high-viscosity oil may be diluted with mineral oil for less severe service; however, it is used full strength for all operations at the Alloy Steel Products Co. This is done because of the short runs and quick change-over required on most operations, making it impractical to change the coolant for every set-up. Approximately 75 per cent of the coolant used is recovered by filtering and recirculating and by placing the chips in a centrifugal extractor. No decrease in the efficiency of the oil has been noted from its constant re-use. Dermatitis has not been encountered while using this oil, even though sterilization of the oil, such as heating or adding of germicides, has not been attempted.

New Aluminum-Alloy Bearing Metal for Automobile Engines

ALUMINUM alloys containing tin, nickel, silicon, and copper were recommended to the Society of Automotive Engineers at the meeting in French Lick Springs, Ind., as new materials for bearings, especially suitable for internal combustion engine design. H. Y. Hunsicker and L. W. Kempf, of the Aluminum Co. of America reported the results of extensive experiments and tests. They said that these new alloys would give superior performance in engine service at extreme loads and high temperatures. These bearing materials are claimed to resist damage by particles of bronze and steel, which they practically absorb. They have high resistance to corrosive attack by organic acids released by lubricating oils. These opinions were supported at the meeting by engineers of the Caterpillar Tractor Co. and Fairbanks, Morse & Co.

The addition of silicon is said to improve the anti-friction and anti-scoring properties of the new material. Under thin-film lubrication conditions, bearings made of the new alloys are said to support much greater loads than conventional bearing materials in similar service.

* * *

The type, quantity, and quality of war material that this nation turned out for its own use and for the use of its allies could not have been attained by men reared under a planned economy.

Designing Work for Bending

Points to be Considered in Order to Perform Economical Bending on Automatic and Manually Operated Bending Machines — Fourth and Last in a Series of Articles on the Application of Bending Machines

By E. J. DeWITT, Vice-President, and
HARRY S. NACHMAN, Engineer
Wallace Supplies Mfg. Co., Chicago, Ill.

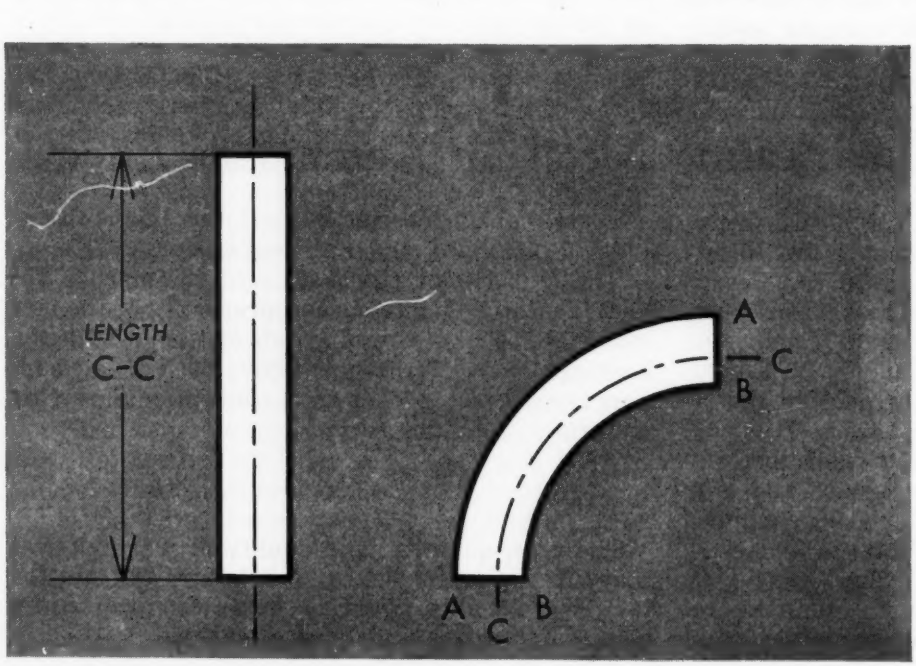
IT is no exaggeration to say that in most cases the best place for performing economical bending is in the shop office or drafting-room. Unless there are very few pieces to be bent, the man in charge of planning and designing for bending can save a great deal of time, effort, and money in the shop by carefully considering how the work can be done most economically. He can use the same size of material whenever possible, and he can design bends of the same shape, made from the same type of material, with a view to enabling the same tools to be used on many different jobs.

The advantages of this kind of design are evident. Rotary machines are the fastest and perform the best bending work. The greater the uniformity called for in the work, the more practical is the rotary machine. There are fewer tool set-ups and adjustments which would cause lost production time. The necessity for tool changes can be further reduced by production planning in conjunction with production designing. This simply means the grouping of all beds of one size or shape into one lot, so that they can all be done with the same tool set-up.

Choice of Material for Bending

Perhaps the most important point in designing for bending is to choose a material that will bend properly and easily. Some materials are more liable to fracture than others during the bending operation. Others can be bent, but will not stay bent to the proper shape. What is needed is a highly ductile material, but even a ductile metal will break when stretched too far. In fact, the common measurement of the ductility of a material is the percentage of its length to which a material can be stretched before breaking. This factor of stretch becomes a very important one in the process of bending.

Examine any bent or curved object, as shown to the right in the accompanying illustration. Obvi-



Diagrammatic Illustration Indicating the Length of the Outside and Inside of a Bend Compared with the Length of the Pipe before Bending

ously, the line *BB* on the inside is shorter than the line *AA* on the outside. Before bending, the tubing had a length *CC*, as shown to the left. This length is shorter than *AA*, but greater than *BB*, which means, of course, that the material has been stretched on the outside and compressed on the inside. Assume that the initial length *CC* is 3 inches, that the bar is bent to a radius of 2 inches, and that, in bending, *AA* becomes almost 4 inches, so that the stretch is approximately 1 inch. The percentage of stretch is then 1 inch in 3 inches, or about 33 per cent.

Now suppose the radius of the bend is 1 1/2 inches instead of 2 inches. As this will require less material, we will assume that *CC* is only 2 1/8 inches. Then the outside length *AA* will be approximately 3 1/8 inches, and the stretch of the material will still be 1 inch. In this case, the percentage of stretch is 1 inch in 2 1/8 inches, or about 47 per cent.

If the material used is ductile enough to stretch only 35 per cent of its length, it will not be possible to use it for making the second bend. Thus, it appears that the two factors of primary importance in the design of a bend are the ductility of the metal to be used and the radius of the bend. Table 1 gives recommended values for the minimum bend radius on materials of different ductility ranging from 10 to 70 per cent stretch. A ductility value of 30 per cent should be used for ordinary steel pipe, tubing, or structural shapes made from low-carbon steel, annealed. The values given in the table are for practical application. Theoretically, a heavy section should bend to one and one-half times its width as easily as a light section does, but in performing the bending, it becomes difficult to clamp and guide the heavy section, so that larger radii are recommended as the width of the material increases.

If a hollow section is being bent, the material along the outside of the bend—line *AA* in the illustration—becomes thinner as it stretches. If the material is bent without being heated, which is the case in bends made on bending machines, this thinning effect does not necessarily make its structure weaker. It is a well-known fact that when ordinary

Table 1. Minimum Radius of Bend Corresponding to Different Percentages of Elongation

Elongation of Material, Per Cent*	Width or Diameter of Material to be Bent		
	Up to 2 Inches	2 to 4 Inches	Over 4 Inches
10	5 × width	6 × width	6 × width
20	2 1/2 × width	3 × width	4 × width
25	2 × width	2 1/2 × width	3 × width
30	1 3/4 × width	2 1/4 × width	3 × width
40	1 1/3.× width	2 × width	3 × width
50	1 × width	1 1/2 × width	2 1/2 × width
60	1 × width	1 1/2 × width	2 1/2 × width
70	1 × width	1 1/2 × width	2 1/2 × width

*It is recommended that the metal supplier be consulted in regard to elongation percentages of metals to be bent.

Table 2. Tube Diameters and Corresponding Minimum Wall Thicknesses Suitable for Bending

Outside Diameter of Tube, Inches	Minimum Wall Thickness	
	Birmingham Wire Gage No.	Inches
Up to 2	18	0.065
2 to 3	16	0.049
3 to 4	14	0.083
Over 4	12	0.109

metals are cold-worked (cold-working is forming at ordinary temperatures), they become harder and stronger. Thus, if we were to saw a bent tube through the middle, we would find the outside wall thinner, but of stronger material, than the original, so that the result need not necessarily be a loss in the total strength of the structure. Of course, there are practical limits to this condition. If a very thin material is bent, its further thinning during bending might reduce its strength to the breaking point.

Table 2 gives minimum gages or thicknesses of tube walls which can be bent in various sizes of tubing under everyday shop conditions. This table covers low-carbon annealed steel tubing. Somewhat thinner wall sizes can be bent to the radii given if stronger materials, such as stainless-steel tubing, are used. Both Tables 1 and 2 have been prepared on the assumption that the minimum bends recommended are made by the use of mandrels. For bends of short radii and thin walls, mandrels are more necessary than for bends of longer radii with thicker walls.

Type of Machine Used for Bending Must be Considered

Having studied the suitability of the material for bending, the designer must now make certain that the bent design suits the machine in which the bending is to be done. If a rotary type of machine is to be used, material must be allowed, exclusive of the bend, for the grip of the clamping die. The length of this allowance will vary according to the bent section. For standard pipe, the desirable clamping lengths range from 6 inches for a 3/4-inch pipe up to 20 inches for a 10-inch pipe. An equal straight length at the trailing or back end of the bend will often prevent the end of the bent pipe from becoming distorted. If the bending is to be done on a ram type machine, the straight length of pipe should be about the same as on the rotary type, and, of course, must be provided for at both ends of the bend.

When more than one bend is to be made in a single piece of material, it is desirable to leave the same straight length of pipe between the bends as recommended to be left at the ends of the bends in the preceding paragraph. In this manner, special tooling and set-ups are avoided. When multiple bends do not lie in the same plane, it is well to consult the engineering department of the bending machine manufacturer to make sure that special

tooling for the operation is practicable. In using a rotary machine, make sure that the length of the machine is sufficient so that the material can be loaded into the machine without interference.

Specifications for Material to be Used

Having decided upon the kind and length of material, the designer should prepare specifications for the material to be used. If the bend is near the critical range, that is, of a short radius or in a thin-walled section, the heat-treatment of the material becomes important. Annealing increases the ductility. It pays to use fully annealed material on difficult bends. Material of uniform temper should always be used on production runs on rotary bending machines, so that the bends will spring equally when using the same form. If the metal to be bent is too hard, it may spring too much or even break, when its ductility is too low for the bend required. If, on the other hand, it is too soft, it may loose its shape too easily.

When welded pipe or tubing is to be bent on a rotary machine, the operator should be careful to place the material in the machine so that the welded seam lies on top when the pipe is in the bending position in the form, as shown in Fig. 1, page 189, of May MACHINERY.

Aluminum Pallets Save Handling Weight and Expense

THE development of aluminum pallets having only one-third the weight of those made from other materials opens up an entirely new field for this method of shipping, since the shipping charges for the pallets themselves are reduced two-thirds. Suppliers to the Army and Navy have been asked to make shipments to the armed forces on pallets, which greatly facilitates the movement of goods from manufacturing plants to supply depots and ships.

When pallets are used, the goods are handled in unit loads by means of power-driven industrial type fork trucks. By this method of shipping, the Navy claims to have saved a great deal of handling time. In one instance, 77 pallet loads accommodated the same amount of goods that would have required 4080 separate packages if shipped loose.

The term "palletizing" has been applied to shipping by the use of pallets. Palletizing is suitable for moving almost any kind of material. It has been successfully applied to such products as rakes and shovels, blankets, bulk material in large bags, glassware, odd-shaped electrical equipment, etc. Obviously, this method can also be used advantageously for conveying parts and materials between two manufacturing plants and for handling within a single plant.

The Reynolds Metals Co., 2500 S. Third St., Louisville, Ky., has developed 40- by 48-inch aluminum pallets that weigh only 36 pounds, compared with about 100 pounds for the same size pallets made from other materials. They are constructed from newly developed high-strength aluminum alloys, and have withstood loads up to 26,000 pounds without damage. The high strength also insures against damage from rough handling.

Aluminum Pallet Weighing Only 36 Pounds that will Handle Loads up to 26,000 Pounds without Damage

* * *

Production is the Only Bulwark Against Inflation

The most important thing in the world at the present moment is to promote more and more production. Increased wages in dollars and cents are of no value whatsoever unless production is simultaneously increased, so that prices do not go up in proportion to the increased wages. If increased wages mean nothing but inflation, all this industrial strife that has taken place is of no avail in benefiting the wage-earner.

* * *

Individual initiative in thousands of manufacturing plants throughout the country, instead of master dreaming in Washington, is the true way to reconstruction and national well-being.

Ford Cylinder Sleeve Production Embodies Unique Engineering Ideas

(Continued from page 147)

tools seen in this illustration are employed on another Barnes machine which is used for final burnishing and honing. There are fourteen rollers on each burnishing tool, 3/8 inch in diameter by about 2 inches in length. The sleeves are revolved at a speed of 550 R.P.M. by the table bushings as the burnishing tools are fed down through them. Only one pass is made by the tools.

The burnishing operation provides a smooth inside surface on the sleeves while they are still soft, and thus final finishing is facilitated. The sleeves are burnished to a nominal diameter of 3.0625 inches, but they expand approximately 0.0015 inch upon their release from the bushings of the indexing table. The sleeves are automatically ejected from the table by hydraulic means as the bushings are indexed back to the loading stations.

Two minor operations are next performed on power presses set up with special tooling. In one of these operations, a slight chamfer is cut on the inside of the sleeve at one end. The second operation faces the end to obtain the desired sleeve length.

The burnished sleeves are next tinned externally preliminary to performing a heat-treatment that will make the inside of the sleeves hard and leave the outside soft. For the tinning process, the sleeves are held on racks such as seen in Fig. 11, which are provided with spherical rubber seats on which the tubes are mounted and held in place with curved flat springs. Similar rubber caps are then clamped on the upper end of the sleeves. These rubber devices protect the inside of the sleeves from the action of the electrolytic bath through which the sleeves are carried by the conveyor. In this process, tin is deposited on the outside of the sleeves to a thickness of 0.00005 inch.

Following this operation, the sleeves are immediately transferred by conveyor to a Holcroft heat-treating furnace, the loading end of which is shown in Fig. 12. The heat-treatment is termed "carbonitriding," and is performed in a controlled atmosphere that consists of approximately one-third catalyst type generated gas and two-thirds ammonia gas. The atmosphere is continuously circulated by five blowers along one side of the furnace. The temperature ranges from 1360 to 1400 degrees F., and the heating cycle is five hours. Eighty trays can be loaded in the furnace at one time, each tray carrying forty-eight sleeves. From the heating zone, the sleeves are passed through a water-jacketed cooling zone, there being no water or oil quench. When they leave the cooling zone, the inside of the sleeves has a hardness of about 450 on the Vickers Micro hardness tester.

The sleeves are next transferred to Barnes machines of the type illustrated in Fig. 13, which are equipped with an automatic loading table, as seen at the left. The sleeves are inserted in spring-clamped holders and indexed into position between two hydraulically actuated plungers which are seen on the left-hand side of the machine. These plungers push the sleeves into bushings in the machine table, the accuracy of which is carefully maintained, so that sleeves which became expanded during the heat-treating process will be squeezed to the desired size when they are seated in the bushings. Two sleeves are loaded in the two bushings of a station at one time, and they are burnished and honed in pairs.

The first working station on the machine is illustrated in Fig. 14. The burnishing tools make only one pass down through the sleeves to burnish them the full length. These tools also serve to force the sleeve metal against the wall of the bushing in cases where the sleeves leave the furnace under size, thus bringing them to the required diameter. Again the sleeves rotate at 550 R.P.M. while the burnishing tools are fed down through them. The burnishing rollers are, of course, revolved by the sleeves.

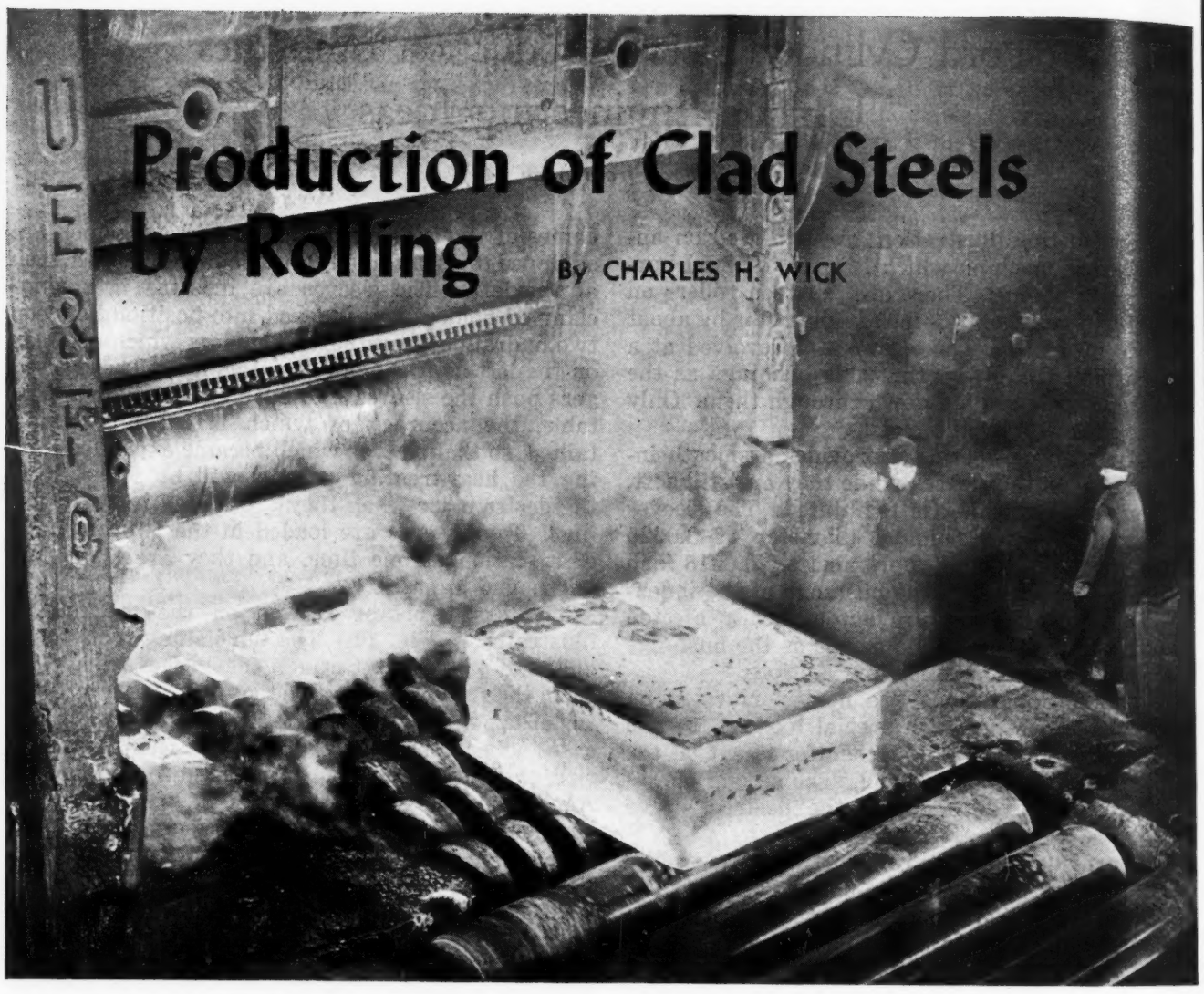
From the burnishing spindles, the sleeves are indexed to a pair of spindles equipped with Micromatic hones provided with 3/8- by 3/8- by 3-inch abrasive stones of 500 H grit. The hones make eight or nine strokes, depending upon the amount of stock to be removed. The sleeves are burnished to an inside diameter of 3.0625 to 3.0627 inches, the tolerance on this operation being only 0.0002 inch. Kerosene is used as a lubricant in both burnishing and honing.

At the end of the honing step, the sleeves reach the station seen at the front of the machine in Fig. 13, where they are automatically ejected. The flange on each sleeve is then trimmed to the required diameter in a minor operation performed on another machine.

After the flange trimming operation, the sleeves reach the inspection table shown in Fig. 15, where every sleeve is carefully checked for length, diameter, and surface appearance. All sleeves that pass inspection are placed on an inclined conveyor that leads to a packing department on the floor above.

* * *

Before 1937 the motor car industry was not unionized and was not greatly influenced by restrictive labor practices. Since 1937, restrictive practices indulged in by automobile workers have substantially reduced labor efficiency in that great industry.—*Louis Ruthenburg*



Production of Clad Steels by Rolling

By CHARLES H. WICK

Methods Employed by Lukens Steel Company in the Manufacture of Corrosion-Resistant Clad Steels, and Points to be Observed in Fabricating These Steels

THE so-called "clad steels" consist of a light layer of corrosion resistant metal, such as nickel, Inconel, Monel, or stainless steel, which is permanently and homogeneously bonded to a thicker backing plate of steel. Lukens Steel Company, Coatesville, Pa., in cooperation with the International Nickel Co., first rolled nickel-clad steel in 1930 for the construction of a tank car that was used in transporting caustic soda. Since that time, its use has grown to a vast number of applications in many industries. Typical uses for nickel-clad steel are in the manufacture of vacuum equipment, evaporators for producing high-purity caustic soda, caustic-soda solution mixing and storage tanks, and processing equipment for resins and plastic materials.

In 1934, Inconel-clad steel was first produced for equipment used in the production of domestic champagne. Since then it has been employed for numerous applications in the food, pharmaceutical, and soap industries. Monel-clad steel was later developed to meet certain needs of the salt industry and for increased resistance to sulphuric acid. It has since found applications in pharmaceutical manufacture and in the petroleum industry. The most recent addition to the family of Lukens clad steels—stainless clad steel—was introduced in the spring of this year, and is expected to have a wide range of applications.

These clad steels were developed to economize in the use of the corrosion-resistant metals, thus making possible the fabrication of large corrosion-resistant equipment which otherwise would not have been economically possible. The clad surfaces possess the same corrosion-resistant properties as the solid nickel, Inconel, Monel, or stainless steel. With these clad steels, savings in material cost up to 60 per cent have been effected. This is especially true of equipment designed to operate under pressure or vacuum, where an appreciable thickness of material is required for physical strength.

Lukens clad steels are produced by hot-rolling,

which bonds the clad metal to the steel plate. While the following description deals with the production of nickel-clad steel, it also applies generally to the other types of clad steels mentioned.

One of the most important preliminary steps in the manufacture of nickel-clad steel is to obtain a clean bond surface between the nickel and the steel. This is accomplished by blasting and pickling the slab of nickel and blasting the side of the steel plate to which it is to be bonded. The nickel slab is then hoisted into position on the steel plate, as shown in Fig. 1.

Fig. 1. A Nickel Slab is Placed Symmetrically on Top of a Larger Steel Plate as the First Step in Preparing a Clad-steel "Sandwich"

The steel plate is larger in both length and width than the nickel slab, allowing space for steel bars which are used to protect the nickel slab. A continuous hand arc weld, using steel welding rod, is then made along the corners formed where the nickel slab rests on the steel plate, as shown in the top view of Fig. 2 and in Fig. 3. Asbestos pads are laid on top of the nickel slab to protect it during the welding operation. Welding spatter is then cleaned from the area, as illustrated in Fig. 4. At the conclusion of the cleaning operation, the asbestos pads are removed and the nickel surface of the welded assembly, which forms half of a pack or "sandwich," is coated with a parting compound, as shown in Fig. 5. This compound prevents bonding of the mating nickel surfaces and permits separation of the pack into two clad-steel plates after hot-rolling.

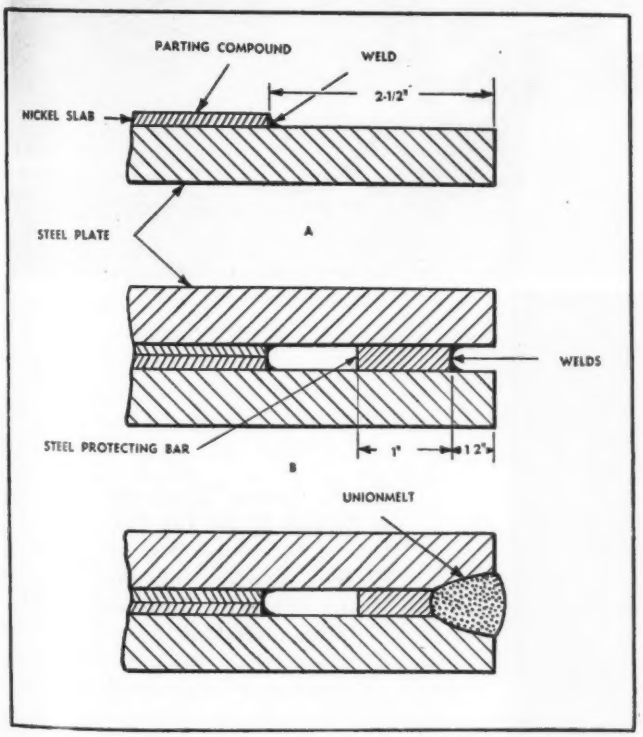


Fig. 2. Steps in Preparation of a Clad-steel "Sandwich." (Top View) Nickel Slab is Welded to Steel Plate, and Parting Compound is Applied. (Middle View) Protecting Bars are Welded to Steel Plates. (Bottom View) "Sandwich" is Completely Sealed by Welding All Sides

The second half of the pack, similarly prepared, is then assembled with the first, as illustrated in Fig. 6, so that the clad surfaces and parting compound come together on the inside of the pack. Steel protecting bars having a thickness equal to the total thickness of the two nickel slabs are inserted in the space between the steel plates. These steel protecting bars are then welded to the steel plates, as shown in Fig. 7 and in the middle view of Fig. 2.

The "sandwich" is next hoisted into position in a pit under the automatic welding machine illustrated in Fig. 8. Steel filler rods are tacked into the grooves on all four sides of the "sandwich" to speed production. Then all sides are welded, as shown in Fig. 9 and in the bottom view of Fig. 2, to form a completely sealed "sandwich." This complete sealing is to prevent contamination and movement of the components in heating and rolling, during which the permanent bonds between the clad layers and their respective steel backing plates are formed.

The pack is now transported to a "soaking pit," where it is heated to approximately 2200 degrees F. to 2350 degrees F. (depending on the type of cladding), as shown in Fig. 10. The temperature is carefully checked by frequent pyrometric readings. Then the pack is moved to a plate mill, where it is rolled, as shown in the heading illustration. Bonding results during this hot-rolling operation, when the steel and clad layers tend to alloy, forming solid solutions at the plane of contact of the

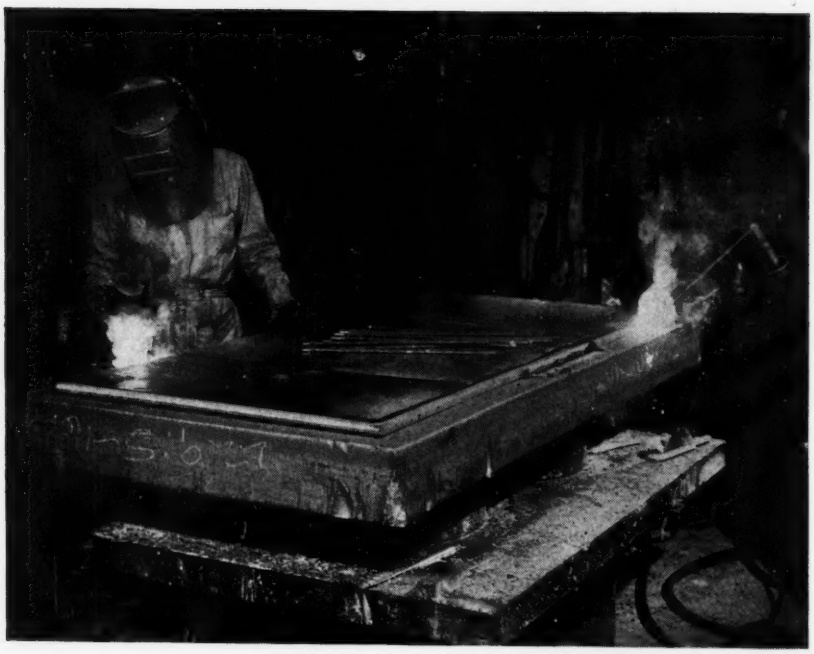


Fig. 3. The Nickel Slab is Arc-welded to the Steel Plates by Hand, Using Steel Welding Rods

Fig. 4. Following the Welding Operation, Spatter is Cleaned from the Weld Area by Wire-brushing

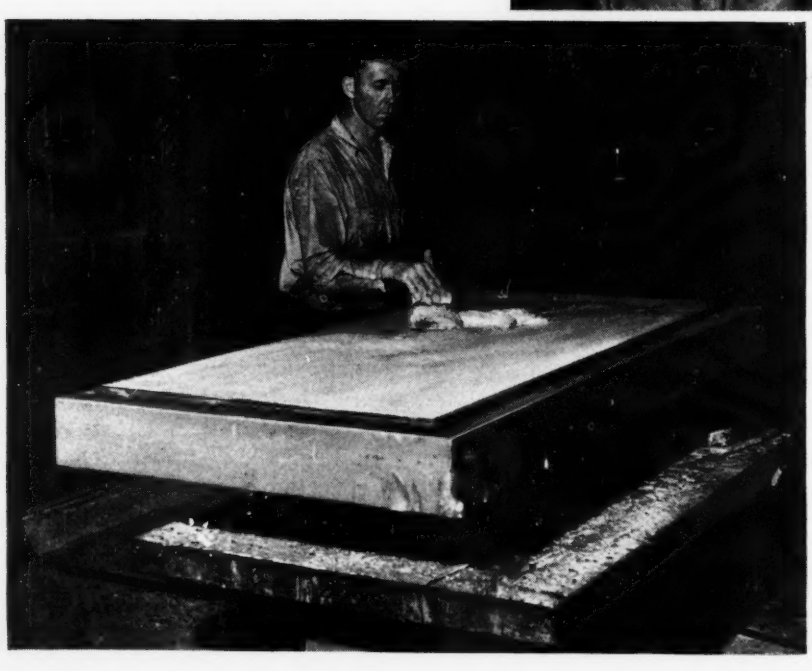


Fig. 5. Parting Compound is Applied to the Top Surface of the Nickel Slab to Prevent Bonding of the Mating Nickel Surfaces during Rolling

Fig. 6. Two Halves of a Clad-steel "Sandwich" are Assembled with the Clad Surfaces and Parting Compound Together on the Inside

two metals. After cross rolling for width and improved physical properties, the pack is turned and rolled to length. Burlap bags, salt, and water are applied to the surface of the pack during rolling to assist in removing scale from the steel.

After cooling, the pack is flame-cut inside the welded edges, as close to the edges of the nickel slabs as possible, and then separated by means of an electromagnet into two nickel-clad steel plates, as shown in Fig. 11.

The clad-steel plates are then cut to the required size, cleaned by blasting or pickling, and carefully inspected. Any surface imperfections are removed by grinding. A waterproof wrapping protects the clad surface of the plates during shipment.

When corrosion prevention necessitates a steel with both surfaces clad, double-clad sheets are rolled in five-ply (three steel plates and two nickel slabs) or seven-ply (three steel plates and four nickel slabs) packs. The five-ply pack produces one steel plate clad on both sides, and the seven-ply pack produces one steel plate clad on both sides and two steel plates each clad on one side. No separation of the layers occurs in these clad steels under normal conditions of temperature change, pressure, vacuum, or mechanical shock. The fact that the mean coefficients of thermal expansion of nickel, Inconel, Monel, and stainless steel are very close to that of steel contributes greatly to the bond strength and provides maximum thermal efficiency in heat transfer equipment. The heat transfer properties of these clad steels are superior to those of steel vessels with applied linings, where the air spaces between the lining and the steel materially retard the conduction of heat. The cladding material possesses the same chemical and physical properties in the clad plates that it has alone in hot-rolled or hot-forged forms. At a tensile load of 55,500 pounds per square inch, a test sample of nickel-clad steel fractured in the steel portion of the sample. The steel was flange quality steel plate with a minimum tensile strength of 55,000 pounds per square inch. The nickel to steel bond in the clad sample remained intact, with no indication of any separation.

The finish obtained in hot-rolling clad steels is a silver gray matte. Clad steels are normally furnished with a clad thickness equal to 10 per cent of the total plate thickness. However, lighter cladding and heavier cladding, up to 50 per cent of the total plate thickness can be obtained. Clad thicknesses of 20 per cent are quite common in thinner plates, such as 3/16 inch and 1/4 inch. The percentage of slab thickness to the original plate is retained in the finished clad-steel plate. The thickness of the corrosion-resistant layer required is determined by the corrosion, erosion, and abrasion conditions encountered in service and the total over-all thickness of the plate. Normal mill sizes for clad steels are: Thicknesses, from 3/16 inch to

Fig. 7. Bars are Welded to the Steel Plates of the "Sandwich" to Protect the Clad Surfaces

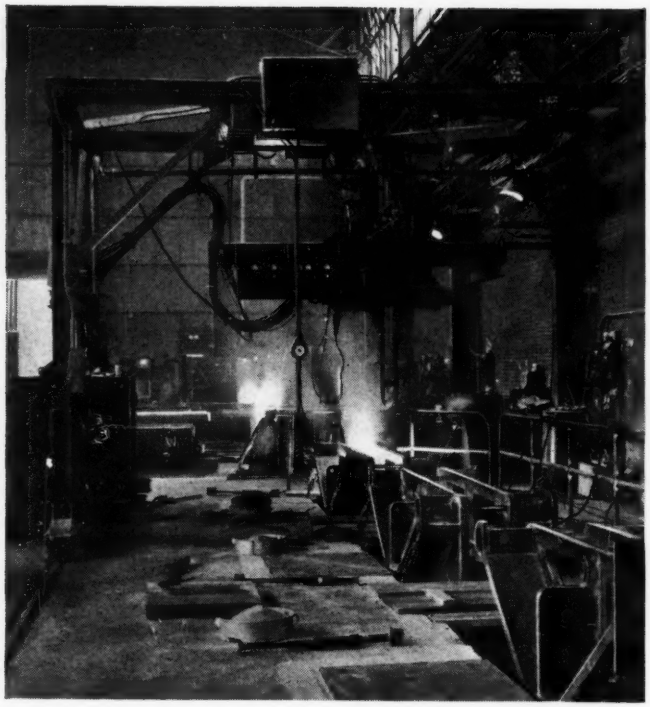


Fig. 8. Automatic Welding Machine for Completely Sealing the "Sandwiches," as Shown in the Close-up View, Fig. 9

over 3 inches; widths, from 48 to 162 inches; lengths, to 480 inches; and circular shapes, up to 162 inches in diameter.

The steel layer is ordinarily flange quality steel, although other grades can be furnished. Since the modulus of elasticity of these clad steels is the same as for steel—30,000,000—the practice followed in designing parts from clad steel is similar to that employed in designing equivalent equipment in steel. Minimum physical properties of clad steels are: Tensile strength, 55,000 pounds per square inch; yield point, 27,500 pounds per square inch; and elongation in 8 inches, 1,500,000 divided by the tensile strength.

Points to be Observed in Fabricating Clad Steels

Fabrication operations such as shearing, bending, flanging, forming, riveting, or welding are performed without buckling, cracking, or peeling of the layers. Practically any formed shape can be made in clad steels. Nickel-, Inconel-, and Monel-clad steels respond readily to hot spinning, and hot- and cold-pressing. Pressing of stainless clad steel is preferred to spinning. Clad-steel blanks for cold-pressing should be annealed. Shearing and punching should be so performed as to throw the burr on the steel side. Clad materials must be carefully handled to avoid damage to their surface.

Standard bending rolls, dies, and tools can be used for clad materials, but they should be thoroughly cleaned to prevent loose scale or steel particles from becoming embedded in the clad surface. Bending rolls are sometimes covered with paper to prevent scratching and gouging of the clad surface between operations. Dies should be carefully dressed to remove any burrs that might gouge the clad surface. To soften clad steels for severe cold-working, each plate should be thoroughly annealed at a specific temperature for the particular type of cladding.

In treating for hot-working, the clad plate should be supported with the clad side up on clean steel rails or clean firebrick, in a location outside the actual zone of combustion. As in treating for cold-working, a reducing atmosphere should be maintained by adjusting the fuel-air mixture to give a soft smoky flame, in order to avoid excessive oxidation. Fuels having a sulphur content of more than 0.5 per cent should not be used, as they may destroy the ductility of the cladding through embrittlement. The best temperature range for hot-working of clad steels is from 1850 to 2150 degrees F.

Flame-cutting of clad-steel plates 5/8 inch or more in thickness should be done from the steel side, with the torch head inclined about 10 degrees and with the tip pointing toward the completed part of the cut. On plates thinner than 5/8 inch, it is preferable to chip through the cladding to the steel with a diamond-point chisel and flame-cut from the clad side through the chipped groove.

The most widely used processes for joining the clad side of the steels

Fig. 9. The "Sandwich" is Completely Sealed by Automatic Welding to Prevent Contamination and Movement of the Components during Heating and Rolling

are electric arc, oxy-acetylene, and resistance welding; silver brazing or soldering; and soft soldering. The process to use depends on the degree of corrosiveness to which the product will be exposed, the thickness of the cladding, the design of the product, and the design of the joints in the product. Several different joining processes may have to be used on a single product.

Electric arc welding is the preferred method of joining clad steel. The steel side of the clad plate should be welded with a suitable steel electrode, and the clad side with an electrode of appropriate composition, as recommended by the producers of the clad plate. The electrodes supplied for welding the clad side are of the heavy flux-coated, shielded-arc type. The core wires are of compositions suited to the particular types of cladding. Nickel and Monel electrodes are suitable only for use with direct-current welders, and are employed on reverse polarity, with the electrode positive and the work negative. Inconel electrodes may be used with either alternating or direct welding current. To insure satisfactory welding of the hot-rolled clad steels, it is necessary to remove the thin, darkly colored oxide film from the immediate vicinity of the area to be welded. This oxide can be removed by machining, blasting, grinding, or sanding with emery cloth, or by pickling.

* * *

Aluminum Bonded to Cellulose Core Forms New Building Material

A light-weight, high-strength, economical aluminum building material known as "Reynalite," which can be produced in large quantities, has been announced by the Reynolds Metals Co., of Richmond, Va. "Reynalite" consists of two sheets of aluminum bonded with a plastic adhesive to a cellulose core to form an attractive panel which possesses permanent rigidity, is easily worked, and is adaptable to a large number of major uses in building construction and related fields.

Tests have shown that Reynalite has a life equal to that of seasoned lumber plus advantages peculiar to aluminum-faced construction. It has proved to be suitable for the construction of walls, ceilings, roofs, interior panels, doors, cabinets, partitions, and other building parts, as well as for railroad car panels, buses, trucks, and trailers. It has also been used for refrigerator linings, electrical cabinets and junction boxes, elevator cabs, air ducts, and heat ducts. Its applicability is widened by the fact that a wood veneer surface can be bonded to either or both of its metal surfaces.

Fig. 10. "Sandwich" being Removed from a "Soaking Pit" after Heating to Approximately 2350 Degrees F. in Preparation for Rolling

High Fuel Saving of Steam Turbines

By reducing fuel consumption from 20 to 50 per cent, the high-pressure steam turbine developed by the U. S. Steel Co.'s Federal shipyard before the war, increased by 1000 miles or more the distance a ship can travel without refueling. —*Steel in the War*

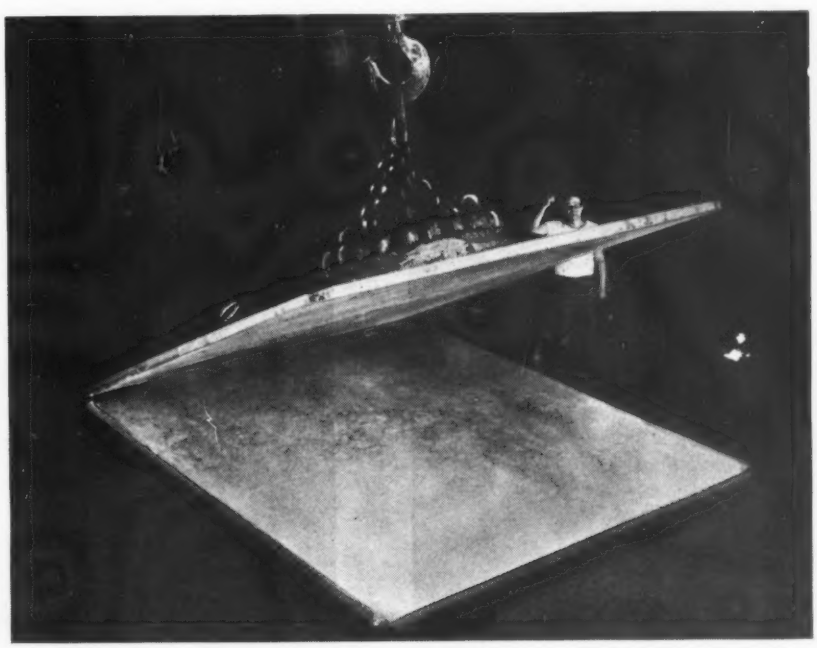


Fig. 11. After Removing the Edges of the "Sandwich" by Flame-cutting, the Two Clad-steel Plates are Separated by Means of an Electromagnet

Gear Manufacturers Association Holds Thirtieth Annual Meeting

THE thirtieth annual meeting of the American Gear Manufacturers Association, held at Hot Springs, Va., June 3 to 5, was attended by a larger number of executives and engineers of member companies than any previous meeting of the Association. Pressing problems facing the industry in these critical days were discussed, and as usual much attention was paid to technical and standardization work.

The meeting was opened by the president of the Association, Paul W. Christensen, president of the Cincinnati Gear Cutting Co., Cincinnati, Ohio. In the course of his address, Mr. Christensen quoted from the address made by his father, the late John Christensen, when he was president of the Association twelve years ago. At that time the industry was slowly emerging from the severe depression of the early thirties. The paragraphs quoted, which apply remarkably to the conditions of today, were as follows:

"We must accept the present era as one of readjustment. A condition and not a theory confronts industry and all business. Only those who have pioneered and blazed the trails through invention and devotion to the sound and honest principles of business are competent to steer the course that shall be pursued now and hereafter.

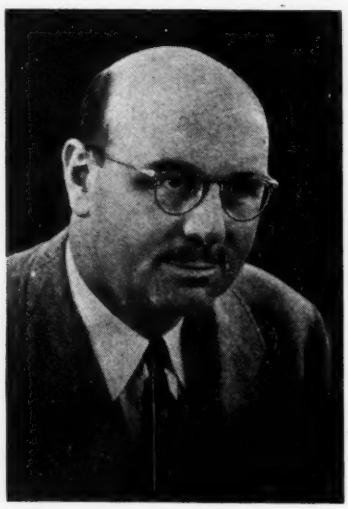
"In this Association, which may be typical of all industry, the approved practices indicate how our industry has striven through research and experimentation to serve effectively the users of its product. Our leaders, for the most part, have, themselves, worked on the machine, and therefore appreciate the part that good workmanship plays in the manufacture of mechanical goods requiring accuracy and durability.

"While with an open mind we should consider methods and practices coming from those outside the industry, it is not conceivable that we can permit theorists, unacquainted with out problems and the conditions that confront us, to run our business. There must be incentive, which may be expressed in various terms, but which the little word profit fully expresses; and whether it be for the employer or the employe, the profit must be there. Profit to the employer represents profit to the employe; and if there is no profit for the employer, the employe must share the distress.

"Surely employer and employe should recognize the responsibility for operating successfully, which will bring to the employe a share of the success."

Tests on the Surface Durability of Gear Teeth

At one of the sessions of the meeting, a paper prepared by T. H. Wickenden, G. R. Brophy, and A. J. Miller, of the Development and Research Division of the International Nickel Co., was presented. The subject of this paper was "An Operating Test for the Evaluation of the Surface Durability of Gears." The authors stated that the various methods for evaluating the surface durability of gears, which include metallurgical tests, tests of gears, and wear tests of specimens designed to simulate gear conditions, have not always accurately indicated service experience. The need for an improved technique for the purpose has been recognized, and an attempt has been made through



Thomas J. Bannan, New President of the American Gear Manufacturers Association

Raymond B. Tripp, New Vice-president of the American Gear Manufacturers Association

W. L. Schneider, Newly Elected Treasurer of the American Gear Manufacturers Association

the cooperation of the General Motors' research staff and the International Nickel Co.'s technical staff to develop a suitable machine and method of test. The aim has been to conduct tests of gears under controlled conditions of load, temperature, speed, and lubrication, and to eliminate as far as possible the unavoidable, complicating variables encountered in the manufacture of gears. The primary concern in these tests was with the deterioration of the tooth surfaces which fail by pitting rather than with the beam fatigue strength of the teeth. Ultimately, it is hoped, a comparison of gear materials and their preparation may be made.

The paper was prepared in response to a considerable interest expressed in these tests. It covered a description of the testing machine in its finally developed form, the test specimen, and the test procedure. One of the important problems encountered was the determination of the point of failure of gear surfaces. The solution of this difficulty was explained in detail. A few test data were presented to demonstrate the results obtainable.

The specimens and the machine were designed by J. O. Almen, J. C. Straub, and F. J. Johnson, of the General Motors Research Laboratory, in cooperation with T. H. Wickenden and E. J. Hergenroether, of the International Nickel Co. The test data covered results obtained on gears made from SAE 4645 steel, quenched and tempered from three hardness levels—from Rockwell C30 to Rockwell C45. The end point of each test was determined by a measurement of the change in the noise developed. The noise-meter used for this purpose was also described.

During the meeting, the motion picture "The Art of Gear Generating," produced by the Fellows Gear Shaper Co., Springfield, Vt., was shown. This motion picture—one of the most outstanding industrial pictures—has previously been described in MACHINERY.

New Officers and Directors

Thomas J. Bannan, president of the Western Gear Works, Seattle, Wash., and its associate organization, the Pacific Gear & Tool Works, San Francisco, Calif., was elected president of the American Gear Manufacturers Association for the ensuing year. Raymond B. Tripp, vice-president and sales manager of the Ohio Forge & Machine Corporation, Cleveland, Ohio, was elected vice-president, and W. L. Schneider, vice-president of the Falk Corporation, Milwaukee, Wis., was elected treasurer. Newbold C. Goin remains executive secretary.

The following members of the executive committee of the Association were elected for three years: Chester B. Hamilton, Jr., president, Hamilton Gear & Machine Co., Toronto, Canada; Fred H. Hoge, president, W. A. Jones Foundry & Machine Co., Chicago, Ill.; Walter W. Trout, vice-president and general manager, Lufkin Foundry & Machine Co., Lufkin, Tex.; and Fred W. Walker, vice-president, Philadelphia Gear Works, Philadelphia, Pa.

Hundreds of Small Strikes Hold up Automobile Production

Although the big automobile industry strikes have been settled, a great number of small strikes in suppliers' plants are seriously holding up automobile production. C. E. Wilson, president of General Motors, stated a few weeks ago that General Motors' operations were being seriously curtailed by strikes in the plants of 142 supplying companies. While public attention has naturally centered on the major troubles—the coal-mining and railroad strikes—one should not lose sight of the serious consequences of the great number of smaller strikes. General Motors' production is reduced to about one-third of what it should be at this time by these minor strikes. The labor troubles in the suppliers' plants cause unemployment in other plants and make it impossible for the automobile manufacturers to deliver cars to thousands of people who must use automobiles in their work. No matter what the merits of the individual labor dispute, the fact remains that, through strikes, the return to national well-being and a normal standard of living is being seriously retarded, unemployment increased, and production held back.

* * *

Research on Closed-Impression Die Forgings

The Drop Forging Association, Cleveland, Ohio, announces a research program on closed-impression die forgings which is being undertaken by the Association in connection with Lessells and Associates, of Boston, Mass. The research will cover studies of mechanical and metallurgical properties of closed-impression die forgings; studies of mechanical and metallurgical properties of other engineering materials; compilation of comparative data on the properties of forged and cast materials; and compilation of basic data for the design of closed-impression die forgings.

Special investigations will also be undertaken to determine the relative forgeability of materials used by the drop-forging industry and the size of equipment required; effect of surface conditions on fatigue strength; importance of flow lines; comparison of soundness in metal products; and effect of size on fatigue strength. The results of the research program will be made available through technical papers read before engineering and metallurgical societies and through the technical press, as well as through the publications of the Association.

* * *

When the Government buys its power with gifts to special groups in exchange for votes, at the expense of enterprising and thrifty citizens, it endangers the very foundations of free government.

Chemical Treatment of Highly Finished Metal Surfaces

Simple, Inexpensive Treatments of Machined Metal Surfaces have been Found to be Effective in Aiding Lubrication and Preventing Seizing, Especially during Initial Running-in Periods. They Also Prevent Scuffing and Welding

DURING recent years, it has become more and more evident that finished metal parts require some form of surface coating as an aid to lubrication and to prevent scuffing and rapid wear. Of recent years there has also been a continuous effort to improve the surface finish of metal parts that are required to operate in contact with other parts under heavy loads. The general belief has been that surface finishes could not be too perfect; up to a certain point this is true, but the statement is subject to qualification.

The need for, and the usefulness of, surface coating on metal parts to improve wear conditions has been investigated thoroughly by the Wilcox-Rich Division of the Eaton Mfg. Co., Detroit, Mich. Important results of this study are discussed in this article. This information is based entirely on the experience of the company mentioned, and therefore information may be omitted on some materials and methods equally useful for the purpose to be attained, but with which the company has not had any experience.

Surface-Finish Developments Have Increased the Need for Coatings

While metal parts have been finished to a higher and higher degree, the necessity for running-in the mating parts has always been recognized. It has become obvious that two parts which have run together for a certain period of time have some quality that cannot be produced by present methods of finishing, and it has been deemed necessary to run parts together slowly with light loads, and to lubricate them copiously during the running-in periods.

One of the most outstanding developments of recent years in the finishing of metal parts is the surface-finishing process originated by the Chrysler Corporation. This method is capable of producing finishes to almost any specified Profilometer reading. The fact remains, however, that perfection of surfaces in itself is not a guarantee against seizure. In fact such perfection invites this difficulty.

C. E. Johansson, of precision gage-block fame, proved, as early as 1917, that two perfectly finished surfaces would adhere to each other as if welded together. He said that the molecules in the separate pieces, if they were wrung together, would be as close to one another as the molecules in each individual piece. Mr. Johansson, in attempting to prove this theory, made two pieces of like material with such perfect surfaces that when about 1/2 inch of one surface was wrung together with another surface of like size, the joint would support a weight of 220 pounds.

Further, O. E. Green of the Johansson Gage Division of Ford Motor Co., reports an instance where two gage-blocks that had been wrung together were left in this condition for some weeks. At the end of this time, it was found so difficult to separate them that when forced apart, particles of one block adhered to the other so tenaciously that the gage surfaces were ruined. This shows that perfection in surfaces can cause seizure.

A number of manufacturers have also found that parts that had run together successfully, when subjected to no other change except improvement in the surface finish, would seize in the initial running together of the parts. This has led to finish specifications of minimum as well as maximum Profilometer readings. It has also led to a practice of producing a certain type of microscopic roughness on a highly finished surface to prevent initial seizing. In other words, it has been found that a certain type of roughness is advantageous in preventing seizing in the initial running.

What are known as excessive-pressure lubricants were found to be useful for the running-in period because they contained sulphur or some other ingredient that contaminates the surfaces and prevents welding. Surface coatings on the parts running together have also been found of value for the same purpose. These surface coatings are the subject of this article.

Requirements for Satisfactory Coating Materials

As early as 1935 the Wilcox-Rich Division started to carry out experiments with surface coatings. In general, the desirable properties of a satisfactory coating seem to be:

1. It must respond to varying degrees of pressure.
2. It should have mild abrasive action to aid the running-in of the two parts.
3. It should slightly contaminate the metal surface to prevent welding.

4. It should absorb oil and thereby improve lubrication.

5. It should etch the surface, leaving a somewhat porous surface to provide an escape for worn-out particles and to form minute reservoirs for oil.

In general, the coatings suitable for the purpose are applied either by electrical or chemical processes. In the chemical group, one of the first coating materials experimented with was potassium sulphide, commonly known as liver of sulphur. This coating proved to be satisfactory as a means of contaminating the surface against welding, but it lacked the other necessary properties of a suitable coating material. It also had the disadvantage of being quite soft and wearing off in a short time.

Ferrous Oxide Used as a Coating Material

A more satisfactory, easily applied material is ferrous oxide, which may be produced on cast-iron parts by heating them to approximately 1050 degrees F., and then introducing steam into the furnace. In many instances, ferrous oxide applied to the surface of cam followers has represented the difference between success and failure. It has also been used with good results on piston-rings and other cast-iron parts.

As an example of the effectiveness of ferrous oxide, the following case is cited. A coating of ferrous oxide on the tappets of farm tractors made possible a normal service life even when the equipment was subjected to severe abuse. A tractor manufacturer found that valve tappet faces were failing in the field after a comparatively short period of use. A ferrous-oxide treatment was recommended for the faces of the tappets. This permitted the tappets to be operated without failure. Unfortunately, however, ferrous oxide cannot be used on steel parts, as the temperature at which the coating is produced would anneal the metal.

The Advantages of Manganese Iron Phosphate as a Coating

One of the most universally applicable and at the same time inexpensive coatings is manganese iron phosphate. The coating is applied in a bath of phosphoric acid containing manganese, at a temperature of about 180 degrees F. This treatment produces an etched surface and deposits a coating of manganese and iron phosphate. Exactly what takes place in the coating action has not yet been fully explained, but it is known that a relatively soft surface having a thickness of from 0.0002 to 0.0003 inch serves the purpose. The mild abrasive properties of the manganese iron phosphate coating also assist in the running-in of the parts. By preventing metal-to-metal contact, this coating eliminates any tendency toward welding. The etching action of the phosphoric acid produces a porous surface under the coating, which provides an escape for worn particles and furnishes minute oil reservoirs that remain even when all traces of the coating have disappeared.

Manganese iron phosphate is apparently applicable to almost any part made from ferrous metals. One example may be mentioned. Manganese iron phosphate was applied to valve guides because trouble was experienced from scuffing of the valves in the engine. The valves had a finish of approximately 5 micro-inches, and the guides were machined to a mirror-like finish with no surface treatment. To overcome the difficulty, a valve finished to 5 micro-inches was run with a guide that was rough-reamed and treated with a manganese iron phosphate coating. This combination of valve and guide ran without scuffing, although it showed heavy bearing marks. Then the valve was finished to from 30 to 40 micro-inches, and run with a guide which was rough-reamed and coated with manganese iron phosphate. This combination gave the best results.

Applications at the Eaton Axle Plant

The application of manganese iron phosphate by the Eaton Axle Division is particularly interesting because of the high pressures and high rubbing velocities involved. This coating is applied to practically all hardened parts in Eaton rear axles, including sliding clutch gears, idler pinions, differential side gears and side pinions, differential spiders, and other ferrous parts, the surfaces of which are subjected to rubbing contact. In this case, manganese iron phosphate is used for the specific purpose of providing pre-lubrication. It has been found that on differentials, in particular, scoring and subsequent failure could be eliminated by the use of this process without any other change.

The Axle Division also uses manganese iron phosphate as a coating to prevent scoring when inserting hardened pins in knuckles. It may also be mentioned that manganese iron phosphate is being used successfully for the treatment of automobile-engine cylinder barrels. In the finish-boring and honing operations, no attempt is made to obtain a particularly low Profilometer reading. As a matter of fact, the cylinder barrel may even intentionally be left with a closely spaced helical tool mark running the entire length of the barrel. The application of the manganese iron phosphate treatment is said to result in the conversion of the surfaces of the cylinder barrels to an oil absorbent coating, consisting chiefly of iron manganese phosphates. This treatment is said to permit rapid running-in, without scoring or scuffing, and to reduce subsequent wear on the cylinder walls.

Surface Coatings Have a Wide Range of Application

Not all applications of surface coatings have to do with high pressures and velocities. Wherever there is danger of scuffing, galling, or seizing of parts, such a surface treatment seems desirable. In one case, leakage occurred between parts assembled by means of studs and nuts. It was discovered that galling was occurring between the

nuts and studs, causing uneven tightening, even when proper torque was registered on the torque wrench. The simple expedient of treating the studs with manganese iron phosphate eliminated the galling, and the parts were drawn together sufficiently tight to eliminate leakage, even with reduced torque on the nuts. By applying the same coating to the studs before they were inserted, subsequent removal without damage to the threads was made possible.

The Wilcox-Rich Division states that undoubtedly there are many surface coating materials and processes that will give excellent results. As mentioned at the beginning of this article, the present discussion is limited to the experience of this particular organization, and to applications with which that organization has had close contact.

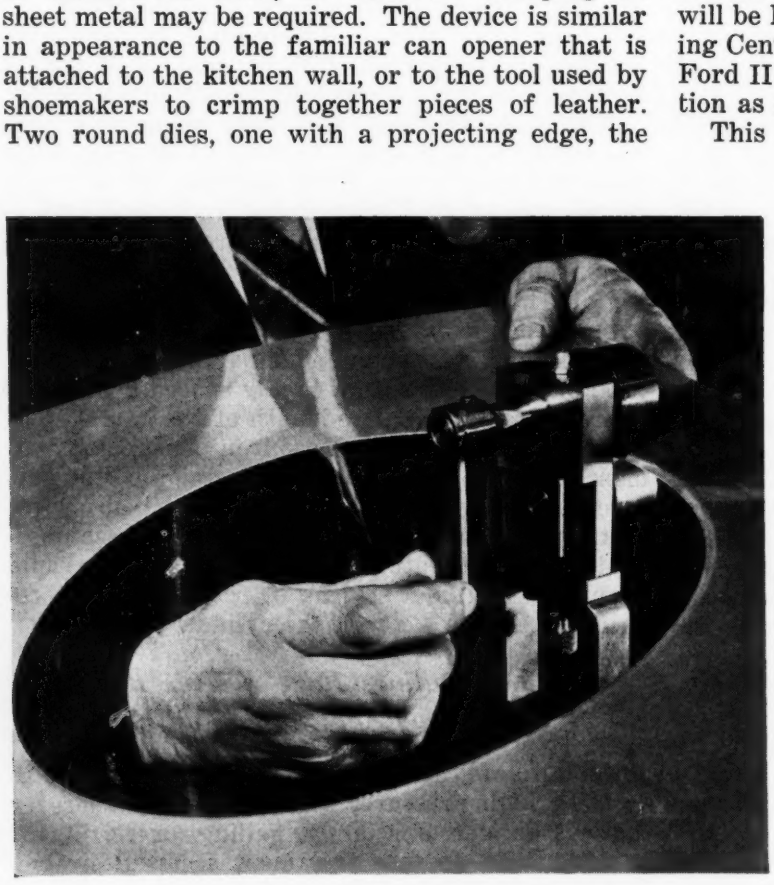
* * *

Convenient and Ingenious Crimping Tool

A useful device by means of which sheet metal up to No. 16 gage can be crimped either at the bench, in the assembly, or after installation has been developed by Frank Lucarelli, a tool designer with the Glenn L. Martin Co., Baltimore, Md. This tool, shown in the accompanying illustration, will work equally well on straight-edged metal, on sheets or pieces curved to any shape, on the inside of blanked-out holes, or wherever crimping on sheet metal may be required. The device is similar in appearance to the familiar can opener that is attached to the kitchen wall, or to the tool used by shoemakers to crimp together pieces of leather. Two round dies, one with a projecting edge, the other rounded to fit the work, are held together by spring tension and are provided with a screw for making adjustments to suit various thicknesses of metal.

By turning a crank, the metal sheet is pulled between the dies. The edge of the metal is crimped to the desired shape while held firmly against a guide. Little physical effort is needed for the operation, and the time saved is at least one-half that required when other types of hand tools are used for this job.

The tool can be operated by clamping it in a bench vise. Substitution of a small wheel for the conventional handle enables pieces to be crimped after they have been installed in an airplane. One of the most important advantages of this tool, compared with previous methods of hand crimping, is safety of operation.



A New Tool Developed for Crimping Sheet Metal up to No. 16 Gage, Shown in Operation

* * *

Ford Research and Engineering Center Planned

The research, development, and engineering activities carried out during the fifty years of existence of the Ford Motor Co. with a view to constantly improving its products are widely dispersed through the manufacturing and production departments. This situation has given rise to problems of coordination, and has led to a decision to concentrate all such activities in one location, which will be known as the Ford Research and Engineering Center. An announcement was made by Henry Ford II recently of the intention to start construction as soon as regulations permit.

This fifty-million dollar project will be named in honor of Henry Ford and Edsel B. Ford. It will be located on a 500-acre tract to the west of the Dearborn Inn, Dearborn, Mich., and will thus adjoin a number of the company's engineering facilities. The first unit to be constructed will be a dynamometer building, which will house advanced facilities for power and efficiency tests on engines and chassis. This building will have thirty-two soundproofed cells, each of 200 H.P. capacity, and there will be two additional cells of 500 H.P. capacity each.

The second unit to be constructed will be a styling building, which will have ten individual studios. Facilities will be provided for duplicating daylight conditions. A fuel blending building will be located near the dynamometer building, from which any one of a variety of fuels can be supplied to any cell in the dynamometer building. There will also be an engineering exhibit building and an administration and engineering building. It is expected that it will require approximately eight years to complete this project.

Surface Grinding with Periphery of Straight Wheels

Typical Examples of the Grinding of Flat Surfaces with Straight Wheels—Third of a Series of Articles on Modern Surface Grinding

By J. C. ARNDT and W. S. HALLOWELL
Simonds Abrasive Co., Philadelphia, Pa.

PROBABLY because surface grinders which grind with the periphery of straight or Type 1 wheels are so widely used in tool-rooms where great accuracy and fine finish are the predominant needs, many shop men do not realize that heavy machines of this type are quite efficient for removing material in cuts as heavy as 1/16 inch. However, merely as stock removers, machines that use segmental or cylinder wheels are to be preferred. Machines that use the periphery of a wheel may be had with either reciprocating or rotary tables.

Reciprocating machines will handle any kind of surface grinding. They are useful for all flat surface jobs, and are essential if slots or formed grooves are to be ground. Because of the line contact between wheel and work and the ease of getting an adequate flow of coolant at the point of contact, the grinding action is cool. Hence, large unbroken surfaces can be effectively ground, which is not possible with segmental or cylinder wheels.

Straight wheels have another advantage over segmental or cylinder wheels because projections do not constitute impassable barriers. Take, for example, the die resharpening job on a Mattison machine shown in Fig. 1. It would be impossible to use a cylinder or segmental wheel on this job without disassembling the die, since the leader pins would be in the way. To remove the leader pins takes time not only for disassembling and reassembling, but also for realigning the die parts that are disturbed in removing the pins. Die surfaces can be reconditioned and edges sharpened in one-third or one-quarter the time that would be required if the leader pins had to be removed. In the same way, straight wheels can grind a surface close to a shoulder. Such a job, done on a Brown & Sharpe machine, is shown in Fig. 2.

The smaller, lighter machines of this type are at a disadvantage in grinding certain types of interrupted surfaces due to the tendency to bell-mouth holes and round off edges. This can be over-

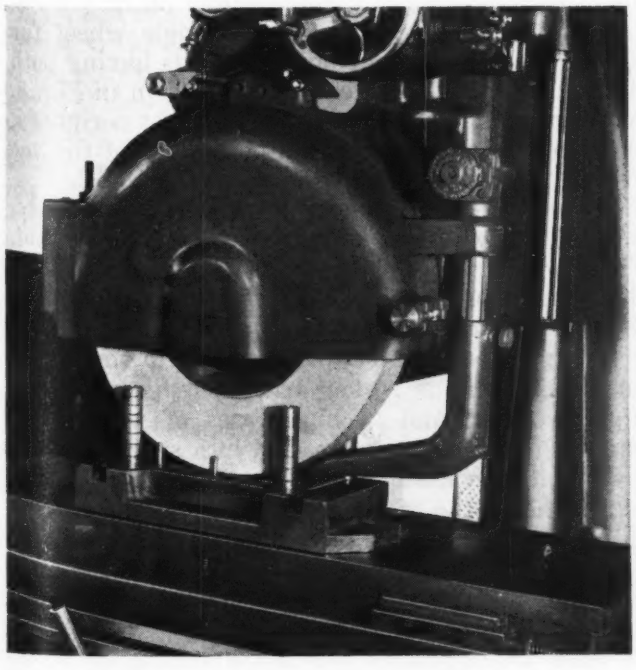


Fig. 1. Resharpening a Die with a Straight Wheel Permits the Leader Pins to be Left in Place

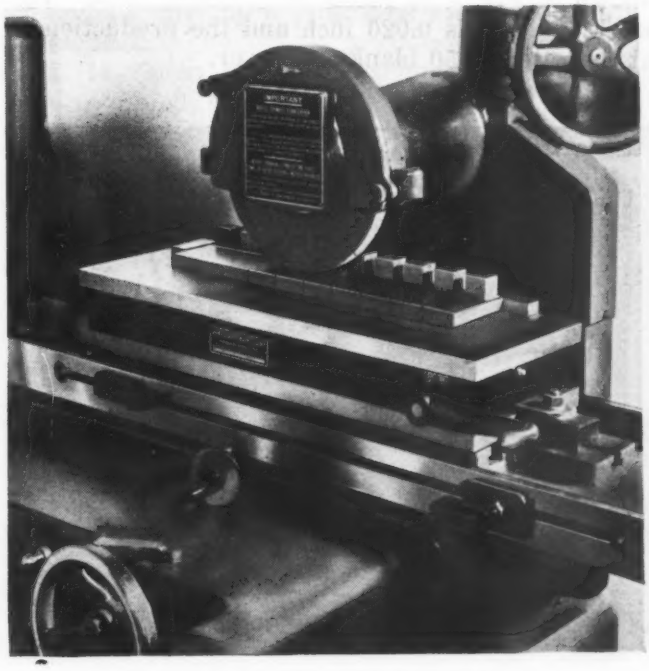


Fig. 2. Grinding a Flat Surface Close to a Shoulder by the Use of a Straight Wheel

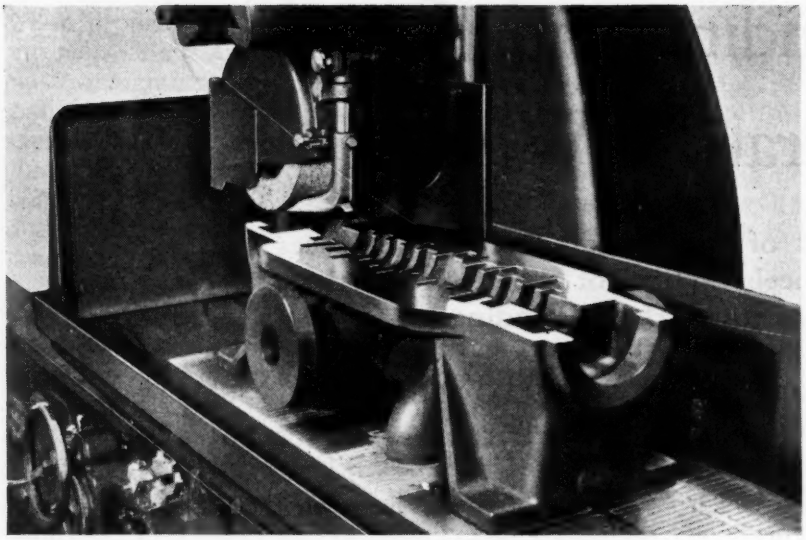


Fig. 3. Work with Interrupted Surfaces Requires Heavy Rigid Machines when Ground with Straight Wheels

come to a great extent when it is possible to use a wheel wide enough to bridge the hole or gap. Heavy, rigid machines are less likely to show this tendency. A case in point is the high-pressure pump case shown in Fig. 3 being ground on a high-powered Mattison machine. Formerly this part was finish-planed and hand-scraped, taking a total of forty hours. The case is ground to a satisfactorily fine finish and to an accuracy of 0.0003 inch in a total of three and one-half hours.

The ability of the reciprocating table to handle large numbers of parts at a single load is often responsible for getting high production, coupled with the accuracy inherent in the method. For example, 500 small nickel-alloy steel gear blanks are ground at one time on the Mattison machine shown in Fig. 4 to limits of $\pm$ 0.0001 inch. The stock removal is 0.020 inch and the production is at the rate of 250 blanks per hour.

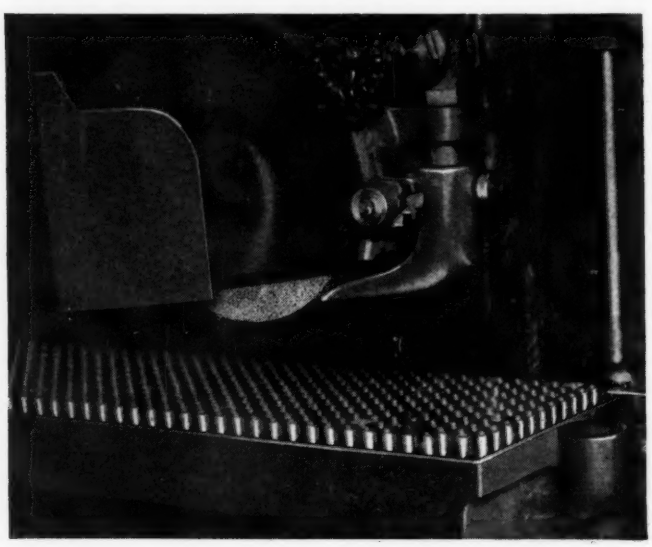


Fig. 4. Grinding Five Hundred Small Nickel-alloy Steel Gear Blanks at One Setting

On the other hand, single large, heavy pieces can, of course, be loaded on the reciprocating table. For example, large Diesel engine blocks are being ground top, bottom, and in the recess on heavy surface grinders to extreme accuracy with a fine finish. Of course, this type of work could also be done on segmental-wheel machines, except for the recesses. Using the edge of a straight wheel makes it possible to grind all of the surfaces at a single set-up, which would be impossible by any other method.

The use of hardened steel ways on machine tools opens a large field for grinding. This calls for machines that can not only grind to great accuracy and fine finish, but that can handle heavy pieces, such as the 5-ton lathe bed in Fig. 5. Incidentally, the hardened ways are held to the bed with bolts. Formerly the bolt heads were filed flush with the ways and then stoned smooth, the grinding of the ways being a separate operation. By using a Mattison straight-wheel grinder, both the ways and the heads of the hold-down bolts are ground to a flat surface of great accuracy at one setting. It should be noted that grinding is the only method that can be used for machining hardened steel ways.

The grinding of ways, when vee ways are involved, often requires formed wheels. Such a job is illustrated in Fig. 6, which shows the grinding of both flat and vee ways on a Hanchett plano-grinder. A straight wheel is used for the flat ways, while a wheel that has been trued on the sides to the right bevel is used for the vee ways. This job saves about eleven hours of hand-scraping on iron ways.

Sometimes it pays to form a single wheel for doing all the surface grinding on beds having both flat and vee ways. An example is shown in Fig. 8. After grinding the flat with the straight periphery, the wheel is moved over and both sides of the vee are ground with the trued sides of the wheel.

By truing the periphery of wheels to contours, many kinds of slots and grooves can be ground. This method also makes possible types of grinding that cannot properly be called "flat surface grinding," but that are nevertheless done on flat surface grinding machines. The narrow slot in the top of an aircraft-engine rocker arm must be ground to high precision and at high rates of production. Eighteen of the pieces are held in a special fixture on a Mattison machine, as shown in Fig. 7. The fixture holds the pieces in accurate alignment. A thin wheel is used for the grinding.

The method of grinding the contour at the ends of airplane-engine articulated connecting-rods is used by many engine manufacturers. It would seem to offer a suggestion for the grinding of other parts that have radii at the ends which must be accurate and of fine finish. The machine shown in

Fig. 9 uses a wheel formed to a concave radius. The fixture, holding 14 rods, is oscillated by power while the table reciprocates to grind the ends of the rods to an accurate radius and fine finish.

Rotary Work-Holding Tables

Flat surface grinders with a rotary work-table, utilizing the periphery of straight wheels, are in many respects ideal for shops that have a variety of surface grinding jobs which must be held to close accuracy for dimension, flatness, and parallelism. However, many such machines are also used on high production work such as piston-rings, collars, washers, dies, disks, and so on.

Fig. 5. Grinding the Hardened Steel Ways on a Machine Tool Bed with a Straight Wheel

With this equipment it is commonplace to hold flatness to 0.0002 inch and parallelism to 0.0004 inch. Much better accuracy than that can sometimes be secured even on a high production basis, as with refrigerator compressor blades. The ends of these are ground, sixteen at a time, to 0.0002 inch for length and 0.00005 inch for flatness and parallelism. To withstand extremely high pressures, it is essential that mating flat surfaces be as nearly absolutely flat as possible. Typical of such parts are high-pressure gate valves which are usually ground on rotary-table machines, using the periphery of straight wheels. The valves withstand pressures of 3000 pounds per square inch.

The surface pattern on the ground work consists of concentric lines—circles when the part is centered on the table, arcs when a chuckload of parts is ground off center.

A typical single-piece job is the grinding of both sides of a clutch plate; the first operation on this part is shown in Fig. 10. The machine used in this case is a Heald. In the illustration, the first side of the plate is being ground flat to a tolerance of 0.0015 inch, in spite of the fact that, as received, the plates are warped. The plate is supported and located from the under side by three spaced studs. Additional support between the fixed locating points is provided by six floating spring-backed studs which can be locked in final position. Three pivoted radial jaws clamp the plate and locate it from the bore.

The second side is ground on the same type of machine; for this operation, the clutch plate is held directly on a magnetic chuck, resting on the previously ground side. A central brass plate locates the clutch plate from the center and prevents its displacement during grinding.

Some rotary-table machines are so designed as to permit tilting of the table, making it possible to grind various surfaces that could not otherwise be ground. Concave surfaces, such as are often used for circular saws or cutting knives, can be ground on these machines. Circular meat-cutting knives are sometimes ground 4 degrees concave on one side, while the outer rim of the other side is ground 25 degrees convex at the cutting edge, which has less than 0.003 inch run-out.

The Heald machine shown in Fig. 11 is grinding a recessed clutch seat in a flywheel. To get down into the recess, the grinding wheel and its motor drive are angularly mounted on the ram and hinged at the rear so that the wheel can be lowered into or raised from the recess by two hydraulic cylinders. The flywheel is located from the bore and a countersunk seat by a plug type fixture attached to the chuck.

Fig. 12 shows a Heald machine equipped for

Fig. 6. Grinding Both Flat and Vee Ways on a Machine Bed at One Setting with Different Wheels

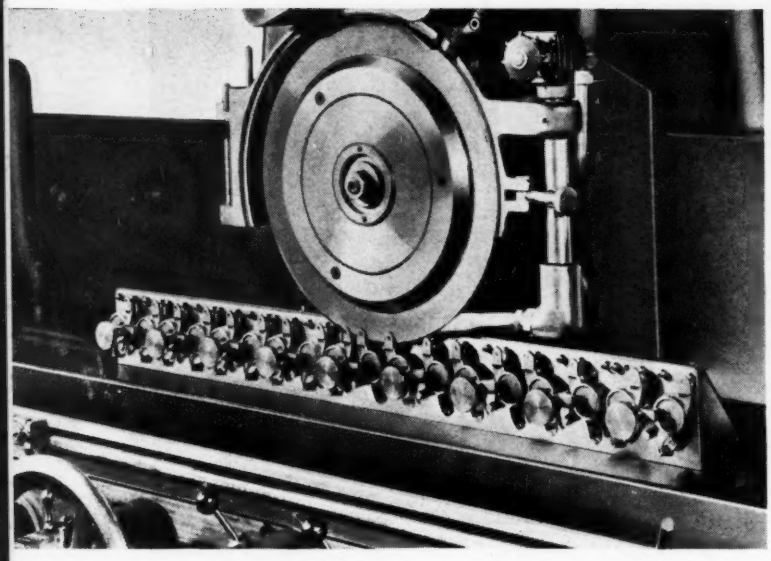


Fig. 7. Grinding a Narrow Slot in the Top of Eighteen Aircraft-engine Rocker Arms at One Time

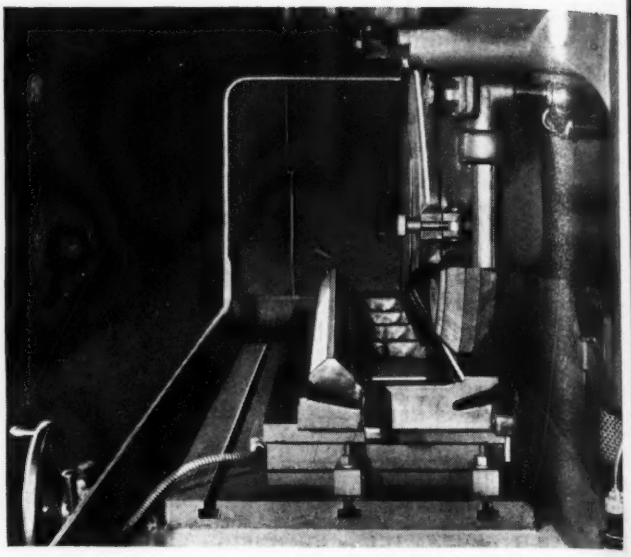


Fig. 8. Grinding Both Flat and Vee Ways on a Machine Bed with a Single Wheel

face- and chamfer-grinding both ends of a transmission cluster gear. The gear is located from the bore by a central stud on the faceplate to insure squareness of the face with the bore. The end of the part is ground in the conventional way, using the standard wheel-slide. The bore is then chamfer-ground with a special chamfering wheel mounted on the angular wheel-slide.

Selection of Wheels for Straight-Wheel Surface Grinding

It is impracticable to give more than general suggestions as to wheel selection, speeds, and feeds for the multitude of flat surface grinding jobs that may come up in a machine shop and in the toolroom. The fundamental factors governing cylindrical grinding apply here as well. It is necessary to take into consideration the nature of the material to be ground, the amount of material to be removed, the tolerances to be met, the finish to be produced, and even the characteristics of the machine and its operator.

The accompanying table of wheel recommendations gives a few typical wheels that have done well on the jobs listed. For a closely similar job, these wheels should not be far off; but only tests under actual shop conditions can be counted on to determine the exact wheel that will do any job best.

In the same way, the work speeds and feeds depend upon the nature of the material, the width of the wheel face, the wheel speed, the amount of material to be removed, and the finish required.

Most jobs are done with a table speed of 15 to 50 feet per minute, although very often higher speeds will give better results both as to production and wheel wear. About 100 feet per minute is the maximum table speed.

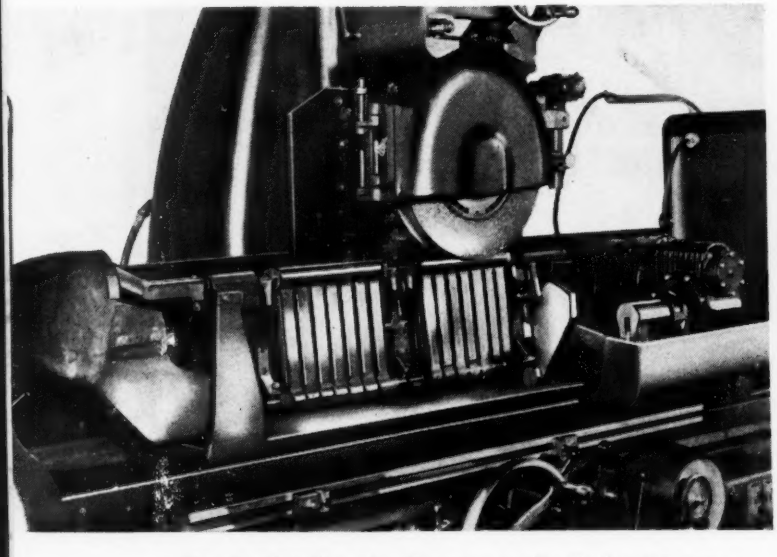


Fig. 9. Grinding the Contour at the Ends of Fourteen Airplane-engine Articulated Connecting-rods

Fig. 10. First Operation in Grinding the Sides of a Clutch Plate, Using a Rotary Work-table

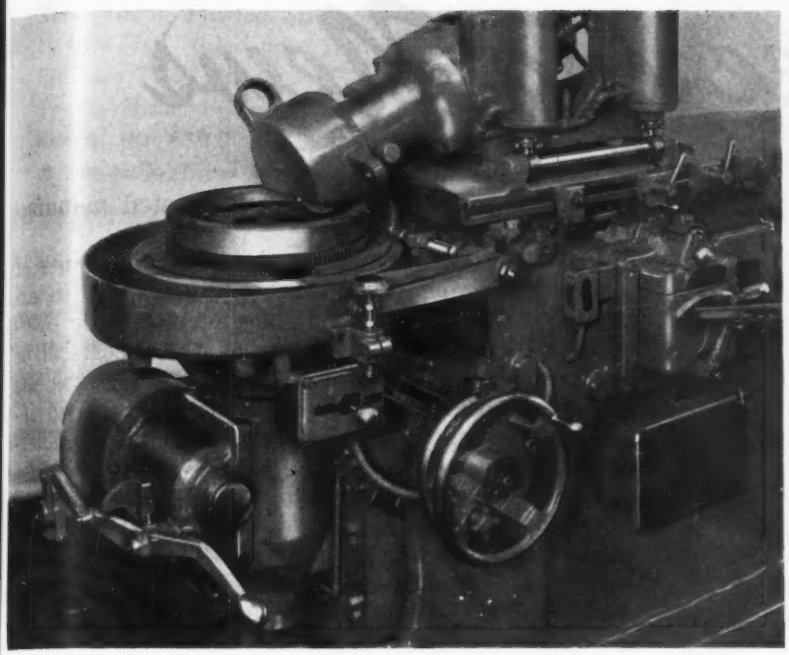


Fig. 11. Grinding a Recessed Clutch Seat in a Flywheel, Using an Inclined Grinding Head

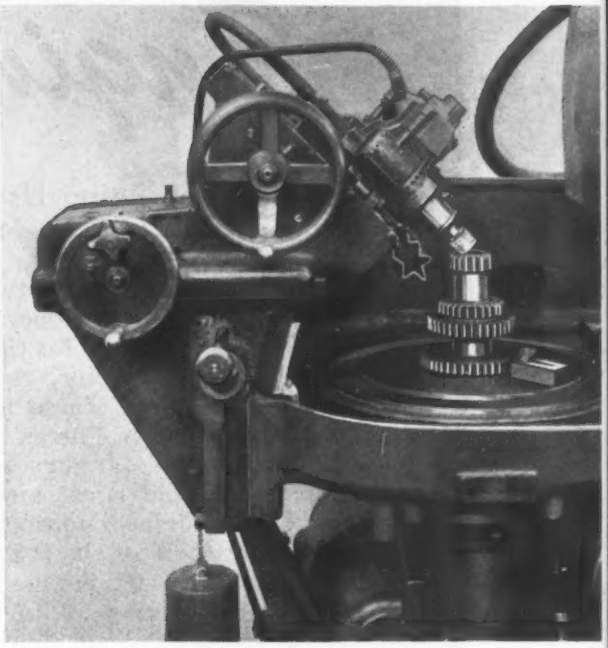


Fig. 12. Grinding Face and Chamfer on a Transmission Cluster Gear

The cross-feed is usually one-half to three-quarters of the width of the wheel, but is varied according to the finish required. When a piece is to be finished in one series of passes with a wheel face about 3/4 inch wide, and a fairly smooth surface is required, a cross-feed of from 1/16 to 1/8 inch is generally used. The depth of cut varies from 0.0005 to 0.003 inch. Often if the work is less than 1 inch in width, a wheel with a slightly wider face than the work can be traversed back and forth, finishing the complete surface in one cut. On heavy machines, the depth of cut can often be as much as 1/16 inch, although for tool-room work from 0.0005 to 0.003 inch is the rule.

Wheel Recommendations for Flat Surface Grinding with Straight Wheels (Type No. 1)

Wheel specifications are according to the standard system of wheel markings of the Grinding Wheel Manufacturers Association

Work or Material	Wheel Specification
Aluminum	C36-I9-V3
Cast Iron	C24-J9-V3
Drawing Dies	WA46-G8-V1
Gears, Hardened Steel	WA46-I5-V1
Guide Bars	A24-J8-V2
Piston-Rings, Cast Iron or Semi-Steel	A60-L5-V1
Steel, Hardened	WA46-H8-V1
Steel, Soft	WA46-I8-V1
Steel, High-Speed	WA46-G8-V1
Stellite	WA46-H8-V1
Cemented Carbides (Dry Grind)	
Tungsten Carbide, Rough	GC60-I9-V3
Tungsten Carbide, Finish	GC120-H9-V3
Tantalum Carbide, Rough	GC80-I9-V3
Tantalum Carbide, Finish	GC120-H9-V3

Training Draftsmen at the Glenn Martin Plant

As a result of the shortage of capable draftsmen in the aircraft industry, the Glenn L. Martin Co., Baltimore, Md., has resumed its engineering drafting classes carried on during the war to provide essential draftsman's training. These drafting classes are conducted with a two-fold purpose in view: To provide actual drafting training in the general sense, and to provide instruction in the Martin organization's engineering procedures and policies. The aim of the classes is not to turn out fully qualified draftsmen, but rather men who are ready to start in a productive capacity and who have sufficient basic knowledge to qualify them to understand and execute such instructions as may be given to them. The experience gained in actually doing their work will gradually qualify them for more exacting duties. Nearly 2600 students have taken this course since the school was first started.

The present classes are made up of approximately 85 per cent returned veterans. At first, the classes were composed of men who were transferred from other work to take the training. A careful canvass of the employes was made, and those who had some engineering or drafting experience were encouraged to apply for admission to the school, provided they could pass the qualifying tests. In general, all applicants are required to have had at least one year of college, during which they should have studied either descriptive geometry or mathematics up to and including trigonometry. This requirement has been relaxed slightly in a few cases where applicants had some basic drafting experience in the aeronautical field.

Engineering News

Flying Laboratories Being Used by General Electric Engineers

A huge B-29 Superfortress and two B-24 Liberators have been converted by General Electric engineers into flying laboratories for the development and testing of jet, gas turbine, radar, and electronic aircraft equipment. These airplanes have been lent by the Army Air Forces to the General Electric Co. for experimental purposes and are being used for testing the latest aircraft developments under actual flight conditions. Suspended from the bomb-bay doors of the B-29 is a torpedo-shaped axial-flow turbo-jet engine developed by General Electric for driving military and civilian planes at great speeds on long flights.

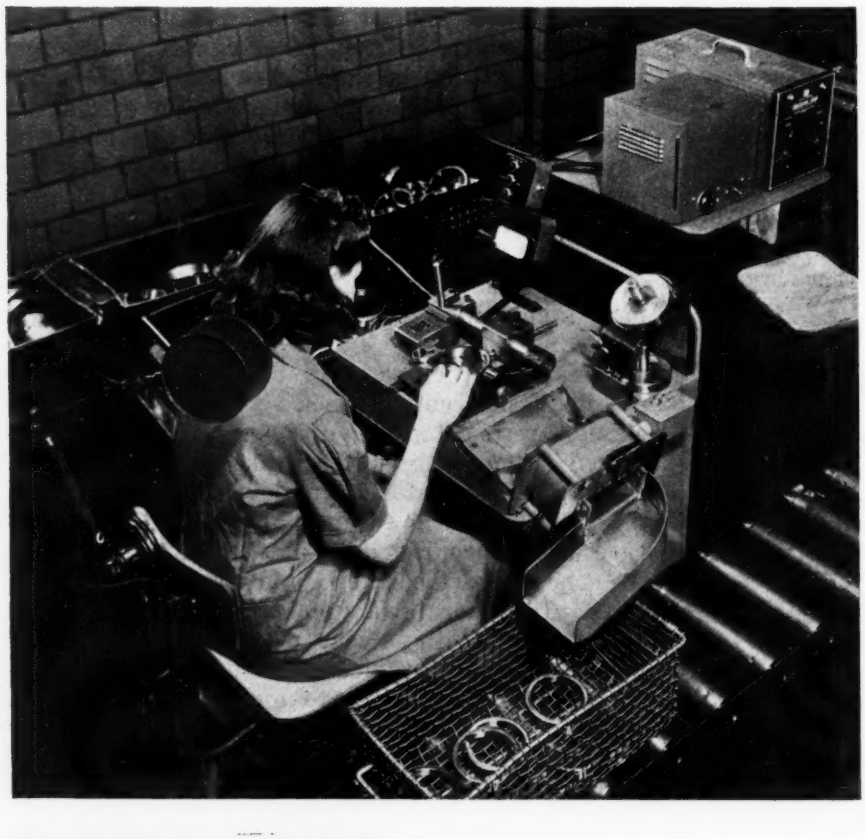
Electronic Sound Gaging Device for Blind Inspectors

A new electronic sound gaging device which may mean the employment of thousands of America's otherwise unemployable blind has been developed by the Timken Roller Bearing Co., Canton, Ohio. The device was developed by Timken engineers to enable the company to give employment to blind Timken veterans, as well as blind civilians. Manufacturing details of the device will be made available by the company to any interested manufacturer without charge.

In the past, the Timken plant has made use of a standard gage for checking dimensions to extremely close accuracies. The gages used by operators with normal sight are of the electrical or mechanical dial-indicator type. In these gages, the inspector observes three different colors—red indicates over-size, green passing, and amber under-size.

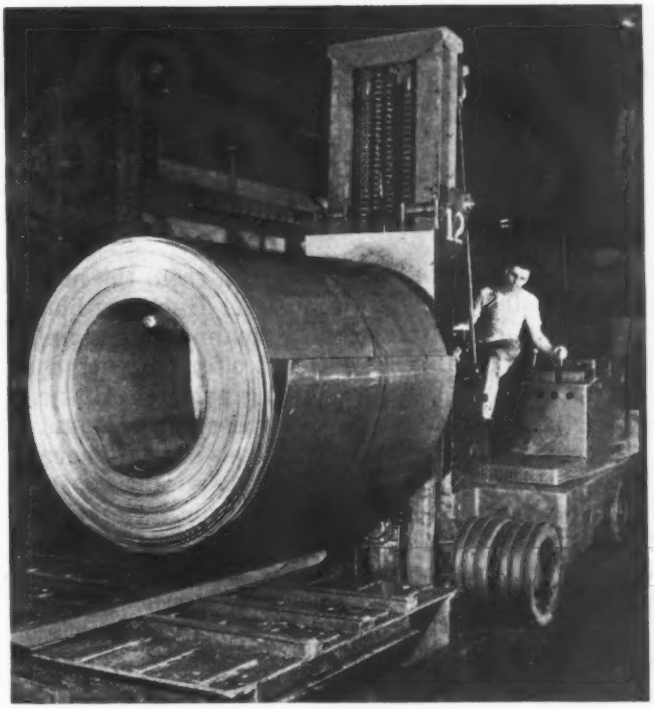
To enable a blind operator to do this inspection work with the same accuracy, a sound indicator is used on the same type of gage. There is a small loud speaker mounted on the back of the operator's chair and connected with an electronic device, as shown in the illustration. The operator hears three different notes issuing from the loud speaker, corresponding to the three colors observed by the seeing inspector. A piece of work that is within the required limits is indicated to the blind operator by the sound of the middle of the three notes. The high note indicates over-size and the low note indicates under-size. At the sound of either of these latter notes the operator rejects the article under inspection.

The three notes are produced by an electronic oscillator, which is controlled by relays connected to the three indicator lights of the electronic gaging system. The chief purpose of using indicator



Electronic Sound Gaging Device which Enables Blind Inspectors to Determine the Accuracy of Bearing Parts to Within Extremely Close Limits

Ten Tons of Pickled Strip Steel being Handled by One Man Aided by a Battery-powered High-lift Ram Type Truck. A Fleet of Eighteen Such Trucks Maintains an Orderly Flow of Production in the $30,000,000 Strip Mill of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa.



lights in connection with the sound indicators is to give the man who sets up each gage a visual check of the accuracy of the gage. The gage is originally set and is adjusted to a master gage; as designed, it will give both visual and sound indication to an accuracy as close as one five-millionth of an inch over or under a specified dimension. Timken engineers spent almost two years experimenting with various gages before this solution was finally determined upon.

Rocket Ascends 43 1/2 Miles at Velocities Faster Than Sound

A rocket developed jointly by the Army Ordnance Department and the California Institute of Technology has soared to a new American altitude record of 230,000 feet at velocities greater than sound. The "WAC Corporal," as the rocket is called, weighs 1000 pounds, is 16 feet long, and 12 inches in diameter. This rocket is at present undergoing further tests at the Army Ordnance Rocket Proving Ground at White Sands, N. M.

The first test of a German-American V-2 rocket will soon be made. A revised model, constructed largely from parts of captured German V-2 rockets, was built with the assistance of German scientists, who volunteered for service in this country. Important information on the ionosphere, such as the composition and density of its gases, temperatures at the upper levels, and possibly the incidence and effect of cosmic rays may be obtained from these tests. Such information will be relayed to the ground by radio telemeters. The Army has twenty-five of these rockets available for assembly, and plans to launch them on a schedule of one a week.

The Steam Turbine Railroad Locomotive Makes Good

In October, 1944, a new type of railroad locomotive took to the rails on the Pennsylvania Railroad. It was puffless and pistonless, being powered by a steam turbine connected to the wheels by a double reduction gear. The first locomotive of this type built in the United States, it was the result of the joint effort of Westinghouse, Baldwin, and the Pennsylvania Railroad. This locomotive has been in service since early in the winter of 1944, hauling, on regular schedule, Pennsylvania's crack passenger trains into and out of Chicago. At no time did any difficulty with the turbine make a train late, nor has the locomotive been taken into the shop for more than routine maintenance.

A few months ago the engineers had their first opportunity to look at the turbine blades and examine the gear teeth that had been carrying loads nearly double those allowed in marine practice. After 47,700 miles in revenue service, the turbine casing and gear covers were removed. The turbine blades and the gear teeth were found to be in perfect condition; no repairs were required. It appeared that the blades and gears would be able to run indefinitely.

This performance of the first of this new type of locomotive is remarkable. It develops 20 per cent more power at high speed than piston type locomotives using the same boiler, which means a considerable increase in efficiency. It has no reciprocating parts, operating as it does with a continuous torque.

Portable Source of Heat for First-Aid Use

A rapid and safe emergency source of heat employing no liquids of any kind, for first-aid use, has been made available by the Mine Safety Appliances Co., Pittsburgh, Pa. This "Redi-Heat Block" consists essentially of a block of light-weight metal with a high heat-transfer value, encased in a special cover and containing a replaceable charge. The charge is a small sealed metal cylinder containing a special chemical compound. The charge is activated by simply raising and releasing a spring-loaded lever, which creates a chemical reaction evolving a maximum safe, dry heat. Only one minute is required to reach top heat. Wrapped in a towel or blanket the block maintains temperature for approximately one hour. The weight of the block is 22 ounces, and it measures 3 1/2 by 4 by 1 1/2 inches.

Obtaining Full Value from Power Hacksaw Blades

By BENJAMIN MELNITSKY

FULL value is seldom obtained from the money invested in hacksaw blades. Hacksaw blades are usually treated in a manner quite unbecoming the time, research, and effort expended by blade manufacturers in devising products that can give long, accurate service. Furthermore, the maximum cutting life of hacksaw blades is not generally obtained. Evidence of the waste resulting from these practices can be obtained from an examination of the discarded hacksaw blades in a typical plant. The number of broken, dull, and useless blades will reveal the causes of excessive blade costs. Such an examination, if careful, will also reveal the means for eliminating this waste.

This article will list the main reasons why hacksaw blades are discarded, and will discuss prevalent bad practices in the usage of blades and methods of improving these practices.

Blade Breakage — Causes and Remedies

Breakage is, of course, the main reason for blade discard. A scrap box filled with broken blades is a clear indication of faulty practice. If a blade is used correctly, it should continue to give good service after the teeth have been resharpened many times. Blades are generally well made, and should break but rarely. They are designed so that the hardness needed to cut the metal is concentrated in the teeth. The body of the blade is made flexible to resist breakage.

Blades break when they are held too tightly in the hacksaw. If a blade is tightened excessively, stresses are set up that will cause the blade to break when any shock or torque is applied. While hacksaw blades should not be too tight, neither should they be too loose. With a torque wrench, blades can be tightened to the correct tension without guesswork or recourse to such primitive methods as feeling the blade to see if it is tight or tapping the blade to hear if it "sounds right." After a short period of experimentation with a torque wrench, the proper tension can be determined for each type of blade and power hacksaw. The correct blade tension should be painted on the side of the hacksaw, so that the operator will know what tension to use when he changes the blade.

Blade breakage is also caused by excessive pressure of the blade against the work. This usually occurs when the blade is too close to the piece at the start of the cut, when excessive feed pressure is used, or when the blade speed is too high. Hydraulically operated machines should be checked periodically to see that the correct hydraulic pressures are maintained and that moving parts are kept in proper alignment.

Improperly adjusted blades will often break. A blade that is loose in the frame will vibrate as it cuts, with the result that the blade will shear at the pin-holes or split in the center. When a new blade is inserted in a machine, care should be taken to see that the blade is not compressed between the two halves of the blade-holder until after tension has been applied to the blade as a whole. If the blade-holders are tightened while the blade is still slack, the holes of the blade will not be drawn up against the pins of the holder. As a result, when the cut is made, the resistance of the metal will cause the blade to slip and break at the pin-holes.

If the blade-holder pins are worn, they may shear while the saw is in operation, causing the blade to break. Work held loosely in the chuck or vise of the hacksaw will turn or twist while it is being sawed and cause the blade to break. When several pieces are being cut at one time, they should be held firmly in place with special chucks or other tools.

An inexcusable cause of blade breakage is the falling of stock under the blade when the cut is finished. When this happens, the cut piece jams between the descending blade and the table of the hacksaw, breaking the blade. This can usually be prevented by adjusting the saw so that it is raised enough to clear the work as the cut is completed.

Carelessness is the chief cause of blade breakage. Most of the causes mentioned could be eliminated by more care on the part of the operator. More care will also eliminate or minimize blade breakage caused by tools and pieces of stock being left in the path of the blade, work swinging against the blade when it is being inserted in the machine, work tipping against the blade when the chuck is loosened, or the use of an incorrect type of blade.

Rejection of Partially Used Blades is Costly

Blade waste also results from the fact that only a portion of the cutting surface is utilized. Most blades are discarded with most of the cutting surface unused. By the application of proper procedures, most of the teeth on a blade can be used.

Waste will be reduced if the shortest possible blades are employed. The practice of using long blades, so that every size and type of stock in stores can be cut on any hacksaw is a wasteful one. Actual experience will usually reveal that the great bulk of the work done in the saw department can be handled with short blades. When large-diameter bar stock is to be cut, one hacksaw, equipped with long blades, may be devoted to such work.

However, no matter how short a blade is used, only a small portion of the blade teeth will do the actual cutting. In order to utilize all the teeth,

the work should be blocked up. This is accomplished by placing a block of metal between the material being cut and the back plate of the hacksaw. This action moves the work toward the center or end of the blade, depending upon the size of block. Then when the blade operates, the center or end teeth will do the cutting instead of the front teeth. The front teeth can be utilized when the block is removed. Scrap stock will serve as blocks.

Another effective way of getting full use from hacksaw blades is to spread the work out instead of piling it up. For example, when twelve bars of flat stock are to be cut, they should be placed on the hacksaw table in six piles of two bars each instead of in two piles of six bars each. This procedure applies not only to square and flat stock, but to all types and shapes of bar stock.

Blades that Cut Crooked—Reasons and Corrections

The main reason why most unbroken blades are discarded is that hacksaw operators claim that the blades will not cut straight. They admit that the teeth are still in good shape, that the blades are straight, and that the blades are still as good as new, but they assert that the blades will not cut straight. Actually, these seemingly good blades have produced crooked cuts. However, the chances are that it is not the fault of the blade. The following are the reasons for such crooked cuts, together with possible remedies:

First, most blades cut crooked because they are loose. A loose blade has enough flexibility to cut around a hard spot in metal rather than passing through it. This flexibility will also cause a blade to twist while cutting. The cure for this is the same as that described for blades that break because they are too tight. Blades must be tightened with accurate measuring devices that will indicate when the correct tension has been applied. Tightening the blade with a torque wrench, as suggested, will usually eliminate crooked cuts, as well as broken blades.

Second, blades will cut crooked if incorrect speeds or feeding pressures are being used. There is only one correct combination of speed and feed for every type and size of material, and the correct speed and feed should be determined before starting to saw. When a different material or size is to be cut, the speed and feed settings of the hacksaw should be changed.

Third, the use of the wrong blade will cause crooked cuts. A thin, flexible, fine-tooth blade used on hard materials will always give poor results. The variables in blades—namely, length, width, thickness, number of teeth per inch, and quality—must be considered in selecting the correct one to use. To attempt to cut tool steel, stainless steel, carbon steel, etc., with the same blade will result in unsatisfactory cuts and excessive blade costs. Yet to change the blade every time a new type of metal is to be cut is even more expensive. The best procedure is that of routing similar types of work to certain hacksaws and using the blade closely approximating that best suited for the materials to be cut.

Other Causes for Rejecting the Blades

When a blade tooth breaks off and lodges in the piece being cut, it will usually strip all the other teeth that follow it. As soon as a tooth breaks off, the machine operator should raise the blade, remove the broken tooth, and start the cut anew. If the bar is almost cut through, the best method is to turn the piece over and finish the cut from the opposite side. However, if the piece is only partially cut, it is preferable to start as though a new piece were being cut and let the blade work its way down to the solid stock.

Hard spots in the material being cut can ruin a blade. When they are encountered, the blade should be raised, the piece turned over, and the work-piece cut from the other side. When wasted material is not important, the work-piece can be moved and a new cut started. The cost of a few inches of scrap stock is usually less than the cost of a new blade.

The entire subject of hacksaw blades deserves consideration. While hacksaw blades are admittedly a very small item in over-all production costs, if efficiency is to be the key-word in this competitive era, the most efficient methods must be adopted in the sawroom, as well as in all other departments. The following check list can serve as a guide in evaluating existing procedures in the utilization of hacksaw blades.

Power hacksaws to be inspected periodically.

Hydraulic fluids to be kept at proper levels.

All hydraulic leaks to be immediately reported to maintenance.

Saw foremen to check setting of machine for all new jobs.

Hacksaw speed and feed to be noted on the blueprint for each job.

Work to be routed to hacksaws in accordance with the type of blades used on the machines.

Shortest possible blades to be used on all machines.

Long blades to be used only on hacksaws that handle large work.

Work to be blocked up to insure cutting action of the blade teeth that have not been used.

Work to be spread out on the hacksaw table instead of piled up.

Torque wrench to be used to tighten all blades to the predetermined tension.

Correct blade tension to be painted on the side of all hacksaws.

Saw operators to be instructed in proper methods of inserting blades in the blade-holder.

Pins of blade-holders to be replaced periodically.

A record of the different types, costs, and brands of blades available to be furnished to the operator.

Proper coolant to be used on ferrous metal.

New blades not to be discarded unless they become dull or cut crooked.

Increased Production the Solution to Economic Problems

AT a meeting recently held in Milwaukee, Wis., to which Joseph L. Trecker, executive vice-president of the Kearney & Trecker Corporation, had invited representatives of the trade and engineering press, the importance of production in the solution of our economic and industrial problems was stressed. This aspect of the economic functioning of the nation has been almost entirely overlooked by our political leaders, by politicians, and by most labor leaders. Unless greater attention is paid to the fundamental importance of production in the furtherance of the well being of all groups in the nation, we are headed for the same economic difficulties as now beset Europe.

Joseph L. Trecker, Executive Vice-president of Kearney & Trecker Corporation

In the course of his address, Mr. Trecker stated five facts that are self-evident to every person that thinks straight and clearly on economic subjects:

1. That the only source of real income increase is increased production; that increased income that does not arise from increased production is quickly lost through increased living costs.

2. That while one source of increased production is increased efficiency of the individual worker, by far the biggest source is increased efficiency of the machine. Increased production accomplished by placing in the hands of the worker a machine which will enable him to increase his output *without*—and this is important—*without* additional physical effort, discomfort, or hazard to his safety, is real increased production which produces real additional income. It adds to the income—the take-home income—of everybody concerned, and particularly to that of two men—the man who owns the machine and the man who runs it.

3. That increased production not only increases income, but increases the purchasing power of that income by lowering costs and prices.

4. That actually there is no such thing as overproduction, in the sense that we can ever produce more than people want. Human capacity to produce is limited. Human desire is unlimited. There have been times in our economic history when we have produced more goods than could be sold, with resultant depression and unemployment. But this was due to maladjustment of price to purchasing power, and never to lack of desire or need for goods, which is the real index of market potentialities and employment possibilities.

5. That individual compensation must be related to output rather than to the time clock.

In further discussing this subject, Mr. Trecker said: "It has impressed me that could the rank and file of worker and the public at large become impressed with the great significance of production, and of the devastating effect on the worker's personal income and economic welfare of any recess or reduction in production—the double penalty paid being in the loss of wages plus increase in prices—there might come a correction of many of the ills from which we now suffer.

"Unfortunately, and for a variety of understandable reasons, a philosophy practically the reverse of this has been implanted in the minds of many of the rank and file of our people. The thought is still widely prevalent that the less work that is done by the individual person, the more work is left for others; the lower the production per man, the more men are required; or, as it is usually stated, the more jobs there will be.

"I am convinced that until the workers of this country and the public at large become sold on the fact that jobs depend on productivity, and productivity alone, an adequate headway in creating and maintaining the degree of employment and prosperity all of us want for this country, will be impossible. I am equally convinced that once there is common acceptance of that fact, and a universal adjustment to that philosophy, practically full and highly paid employment will follow as naturally as night follows day."

The speaker added the following quotation: "Living standards do not rise by any magic formula. They can rise only when workers produce more per hour and per year of work." This quotation, he said, indicated that there are some labor leaders who recognize this fact, because the quotation is taken from *Labor's Monthly Survey*, a publication of the American Federation of Labor.

In conclusion, Mr. Trecker outlined a program for bringing home to the workers and the public the facts he had emphasized, so that all may benefit from the results of increased production.

Induction Hardening Speeds up Lead-Screw Production

By Substituting Localized Hardening of the Finished Lead-Screw Thread for Through Hardening of the Lead-Screw Bar, Elongation and Distortion were Greatly Decreased and Grinding Time was Reduced by More than Half

By CHARLES H. PARKS, Assistant Works Manager
The Bullard Co., Bridgeport, Conn., and
Dr. JOSEPH LIBSCH, Consulting Metallurgist
Lepel High Frequency Laboratories, New York City

DURING the war, the demand for lead-screws for use in precision machine tools reached an unprecedented peak. As the equipment available to produce such lead-screws was limited, it became necessary for each manufacturer to study his production methods and to find new ways of reducing unit production time. Such a study by the standards and heat-treatment departments of the Bullard Co., in Bridgeport, Conn., revealed that the production of lead-screws was limited by extensive grinding required after heat-treatment to eliminate lead errors. Further study to reduce the elongation and distortion that occurred during heat-treatment and thus decrease the grinding time, finally led to progressive surface hardening by induction.

Previous Methods of Producing Lead-Screws

Lead-screws manufactured at this plant vary from 1 1/2 to 1 5/8 inches in diameter and from 36 to 96 inches in length. They generally have an Acme form thread with a 1/4-inch pitch and either a 1/2-inch lead (double thread) or a 3/4-inch lead (triple thread). The material from which they are made is S A E 3250 steel.

The history of hardening lead-screws contains accounts of various methods developed to minimize distortion and lead elongation. In one method that was tried at the Bullard plant, the screws were normalized at 1550 to 1575 degrees F. prior to machining. Before final machining and hardening, they were stress-relieved at 1200 to 1250 degrees F. After stress-relieving the Acme thread was cut on a Pratt & Whitney thread miller, the screws were hardened, drawn at 350 degrees F. for three hours, straightened to correct distortion, and then finish-ground carefully to correct lead elongation resulting from heat-treatment. All heating operations were performed with the screw in a vertical position to minimize distortion.

Just prior to adopting the method of progressive surface hardening by induction, the Bullard Co. followed the procedure of hardening the lead-screw bars and then grinding the thread from the solid to avoid lead elongation. The lead-screw bars were through heated to a temperature of 1450 to 1475 degrees F. along their entire length while held vertically in a heat-treating furnace. They were then quenched in oil, and subsequently tempered to develop a uniform hardness equivalent to 47 to 49 Rockwell C. After hardening, the pieces were

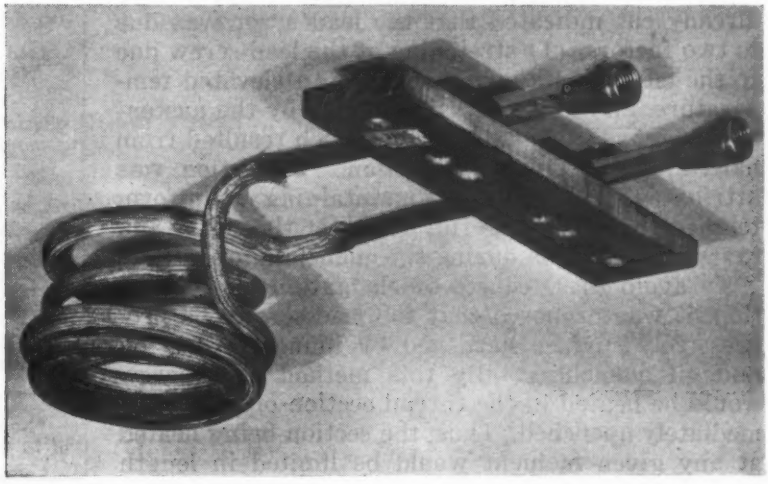


Fig. 1. Multiple-turn Heating Coil Used for Hardening Lead-screws. Two Extra Turns are Wound over Lower End to Intensify the Field

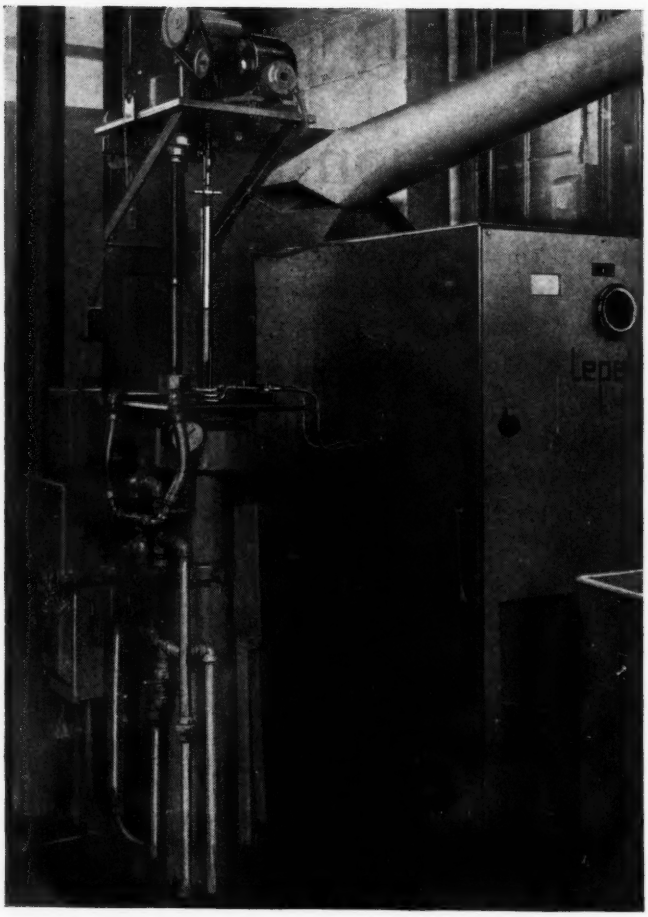


Fig. 2. Arrangement for Feeding Lead-screw down through Heating Coil and into Oil Quench Tank. The Oil Quench Ring is just below Heating Coil

straightened to correct distortion and the threads were then ground.

While this method provided screws with excellent lead accuracy, the time required for grinding the entire thread in the hardened bar was excessive. A new method was therefore proposed and developed.

Proposed Induction Hardening Method

An analysis of the lead elongation resulting from furnace hardening a number of screws with threads already cut indicated that the lead error was due to two factors, (1) stretching of the lead-screw due to the effect of its own weight at an elevated temperature, and (2) expansion caused by the austenite-martensite transformation, which resulted from hardening the full cross-section. Distortion was attributed to difficulty in maintaining a uniform temperature along the full length of the screw and to its manipulation during the quenching operation.

To avoid these causes of elongation and distortion, it was proposed that the lead-screws be progressively surface hardened by induction heating and oil quenching. By this method each screw would be heated in the thread section only and immediately quenched. Thus, the section being heated at any given moment would be limited in length and depth, so that the core would always be in a relatively cool and strong condition. Any elongation due to the weight of the lead-screw such as occurs in a through-heated section would, therefore, be avoided. Furthermore, any expansion accompanying the austenite-martensite transformation would occur in the thread section rather than in the solid core, so that cumulative errors producing an increase in over-all length would be avoided. In a single tooth, such expansion would be extremely small, and could be easily corrected in the final grinding operation.

It was hoped that distortion would be minimized by the use of mechanical handling throughout the heat-treating process, together with the uniform local heating provided by induction, followed immediately by an oil quench. At the same time, it was believed that the service life of the finished lead-screw would be improved by the higher hardness of 55 to 60 Rockwell C obtained on the surface of the threads and by the ductility of the lead-screw core. The former would tend to increase wear resistance and thus assure long accuracy, and the latter would help to absorb the shock of sudden loads. It was also believed that the ductility provided at the roots of the threads by restricting the hardened area to the tops and sides of the threads would greatly reduce the danger of cracking while cold-bending to correct distortion resulting from heat-treatment.

For these reasons, the Bullard Co. undertook an extensive program to develop this application.

Method of Induction Hardening Finally Utilized

In the method as finally developed, the lead-screws are induction heated by high-frequency current supplied from a 30-KW spark-gap converter manufactured by Lepel High Frequency Laboratories, Inc., operating at a frequency of approximately 300,000 cycles per second. The multiple-turn heating coil shown in Fig. 1 is used. The coil is

Effect of Induction Hardening on Elongation of Vertical Feed-Screws

Lead-Screw Number	Over-All Length of Screw before Hardening*	Over-All Length after Hardening and Drawing*	Lead Elongation
1	61.610	61.6147	0.0047
2	61.635	61.6362	0.0012
3	61.640	61.6438	0.0038
4	61.634	61.6355	0.0015
5	61.608	61.6093	0.0013
6	61.669	61.6729	0.0039
7	61.655	61.6572	0.0022
8	61.636	61.639	0.003
9	61.622	61.6248	0.0028
10	61.612	61.6148	0.0028
Average	.....	.....	0.0027

*Note: Measurements made with screws at a constant temperature of 70 degrees F.

formed of 1/4-inch copper tubing, the diameter of the turns decreasing and the air gap between the turns diminishing from top to bottom.

This coil is similar to those normally constructed for use with spark-gap type induction heating equipment, except that two extra turns are wound over the lower end of the coil to intensify the field. Woven glass tubing covers the turns of the coils to insulate them electrically, since the coupling is close. A holding fixture rotates the screw at 15 R.P.M., and feeds it down through the heating coil at a rate of approximately 5.3 inches per minute. With this rate of feed, the screws are heated to a temperature of 1500 to 1550 degrees F. just prior to the quench.

The mechanical fixture developed for progressive feeding of the lead-screws through the coil is shown in Fig. 2. The machine consists primarily of a carriage, properly counterweighted and guided by a vertical H-beam, for moving the screw downward at various controlled rates. The carriage can also be traversed upward or downward at a relatively rapid rate by means of a feed-screw and nut. The lead-screw to be hardened is fastened to the movable carriage by means of a tapped hole in the end of the lead-screw. Provision is made to rotate the screw at 15 R.P.M., in order to assure uniform heating.

The quenching operation, which takes place immediately after heating, is carefully controlled, and the quenching fixture is an integral part of the hardening fixture. The medium is oil, thermostatically maintained at a uniform temperature. Quenching takes place in two steps—(1) by means of a flow quench located 1/4 inch from the lower end of the coil, and (2) by means of an oil bath in a cylindrical tank, approximately 8 inches in diameter and 96 inches long. The flow quench is provided by a quench ring with two rows of overlapping elongated orifices through which uniform streams of oil are directed against the heated screws. A spray quench was avoided, since it was found that turbulence in the oil should be reduced to a minimum to obtain uniform results. Immersion in the oil bath immediately after the flow quench has been found absolutely necessary to prevent incidental tempering of the hardened zone of the screw. A constant oil level is maintained in the tank to insure a minimum time interval between the flow quench of a given section and its immersion in the oil bath. After being fully quenched, the screw is given a low temperature draw at 300 to 350 degrees F.

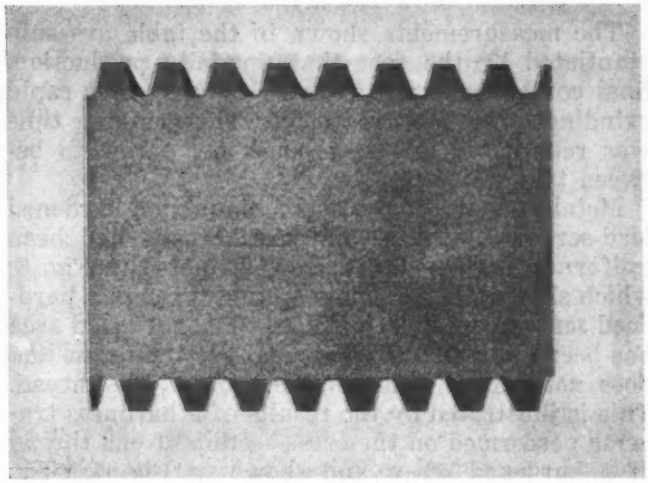


Fig. 3. Longitudinal Section of Lead-screw, Showing Hardened Area in Thread Sections. Note that Hardened Area does not Extend Quite to Roots of the Threads

Results Obtained by Induction Hardening Methods

The accompanying table shows actual results of lead elongation measurements made on ten lead-screws which were induction hardened by the method just described. These lead-screws, which were to be used as vertical feed-screws, had a thread length of 42 inches; an outside diameter of 1.618 to 1.620 inches; and a triple Acme thread of 3/4-inch lead and 1/4-inch pitch. The average lead error measured over the 42-inch length was 0.0027 inch. The total run-out over this length was approximately 0.007 to 0.015 inch when the screws were induction hardened and immediately drawn.

These results showed that induction hardening had almost eliminated lead elongation during heat-treatment. Moreover, while some distortion occured, it was much less than that experienced in furnace hardening, and because of the ductility maintained at the roots of the thread, could be readily corrected by cold-straightening without danger of cracking the lead-screw.

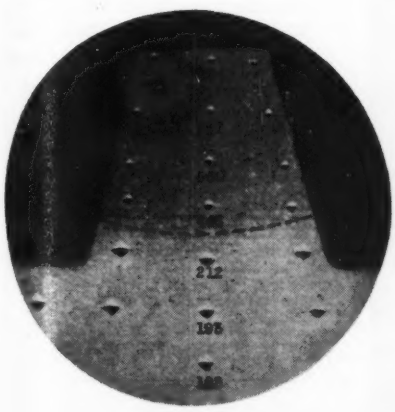
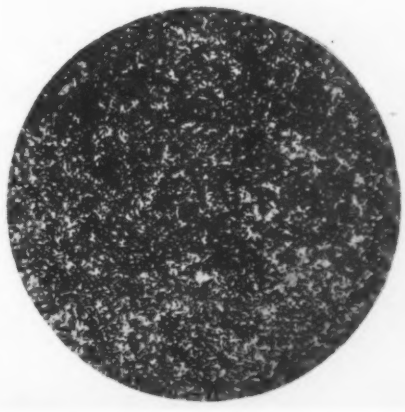


Fig. 4. (Left) Results of Hardness Traverse of Screw Thread Section, Showing Limits of Hardened Area. The Figures are Vickers 10-kilogram Hardness Numbers

Fig. 5. (Right) Photomicrograph of Hardened Section, Showing the Microstructure that is Produced by Induction Hardening



The measurements shown in the table are substantiated by the fact that, in daily production, final corrections were effected by easy and rapid grinding after heat-treatment. The grinding time was reduced from seven hours per screw to between two and three hours.

Metallurgical analysis of induction-hardened lead-screws indicated that the threads had been uniformly hardened. This will be noted in Fig. 3, which shows a longitudinal section through a hardened screw magnified 1.1 times. The hardened area has been restricted to the threads of the screw and does not extend quite to the root of the thread. This is illustrated by the results of a hardness traverse performed on the cross-section of one thread of a hardened screw and shown in Fig. 4. The microstructure resulting from induction hardening is shown in Fig. 5.

In order to check the wearing qualities of induction-hardened lead-screws, a testing machine was set up to simulate operating conditions. This machine was run continuously night and day until 180,000 reversal cycles were completed. The lead-screw was then removed and checked, and no measurable wear could be found.

Approximately 1000 of the screws described have been hardened by induction and placed in service. No failures have been recorded up to the present time, and field reports indicate good performance. Results of grinding after hardening attest to the uniformity achieved from lead-screw to lead-screw.

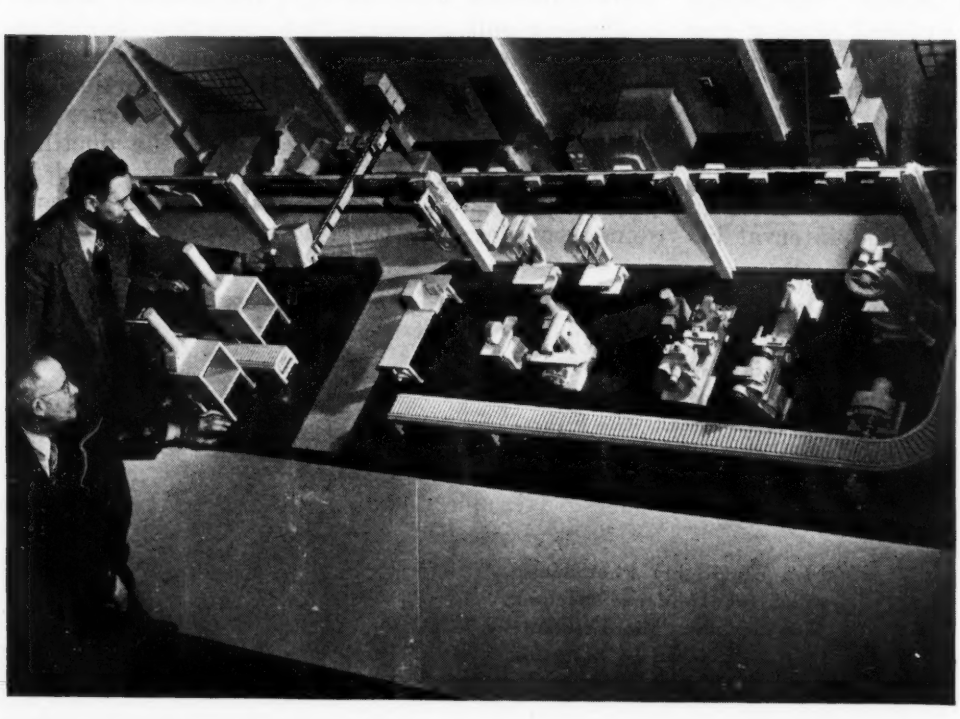
Westinghouse Productive Power Exhibit

MODERN electrical equipment and methods that will assist manufacturing industries to overcome rising costs by producing faster, better, and more economically are featured in a Westinghouse "Productive Power" Exhibit which was recently presented at a conference of the Edison Electric Institute in New York City. This exhibit will be displayed and demonstrated during the coming year in practically all the industrial cities of the United States.

The need for adequate wiring in modern industry is demonstrated by a scale-model factory lay-out, which emphasizes the advantages of better wiring, power-factor correction, and the application of circuit-breakers and condensers. Scale models of machinery and other equipment are moved around on this factory lay-out to illustrate the ease with which machinery can be relocated when a factory is equipped with modern electrical facilities.

Included in the features of the exhibit is a modern resistance welding machine with electronic controls, which is shown in operation. The strength of the welds is illustrated by tensile tests. Improper factory lighting and improved methods are demonstrated by models. An animated sound slide film shows how mass production by electric furnace brazing is possible. The efficiency of infra-red drying is demonstrated by comparison with forced-air and heated-air drying.

The speed, selectivity, and advantages of radio-frequency heating are presented by means of a sound film, demonstrations, and a discussion of specific case histories. In the air handling and conditioning part of the exhibit relative advantages of mechanical and electrical air cleaners are shown.



Scale Models Provide a Unique Method of Demonstrating the Flexibility of Plant Lay-out and the Ease With Which New Machines are Installed when Adequate, Modern Electrical Bus-conduits are Provided

Secret Wartime High-Temperature Alloys Now Available for Peacetime Use

Several Haynes Stellite Alloys have been Developed During the War that are Finding Peacetime Applications in Fields Calling for High-Temperature Creep and Rupture Strengths

EARLY in the war, there arose a demand for aircraft superchargers that would operate over wide extremes of temperatures. The possibility of building the exhaust gas turbines for these superchargers depended upon the development of new alloys that had good creep and rupture strengths and oxidation resistance at temperatures of 1200 to 1500 degrees F., and also could withstand the thermal shock of extreme temperature changes from sub-zero levels to those in the 1200 to 1500 degrees F. range.

The Union Carbide and Carbon Research Laboratories, Inc., in cooperation with the Haynes Stellite Co., engaged in a program of research to develop the needed high-temperature alloys. One of the first to be produced for use in the superchargers was a casting alloy known as Haynes Stellite alloy No. 21. As shown in Table 1, this alloy has a straight cobalt base, a high chromium content, some carbon, and some molybdenum for reinforcing the high-temperature strength imparted by the cobalt.

The buckets for the turbine wheels of the turbosuperchargers employed in American combat aircraft during the war were made almost entirely of this casting alloy. These cast buckets were welded to a forged wheel made of an alloy containing about 16 per cent chromium, 25 per cent nickel, and 6 per cent molybdenum. The performance of the buckets was of a high order. In a more recent de-

Table 1. Haynes High-Temperature Alloy Compositions

Element	Alloy Designations						
	No. 21	No. 23	No. 27	No. 30	No. 31	N-155	N-153
	Composition, Per Cent						
Chromium	28.0	28.0	28.0	28.0	28.0	20.0	16.0
Molybdenum	6.0	...	6.0	6.0	...	3.0	3.0
Tungsten	...	6.0	...	...	7.5	2.0	2.0
Nickel	...	...	33.0	16.5	12.0	20.0	15.0
Columbium	...	...	...	...	...	1.0	1.0
Nitrogen	...	...	...	...	...	0.14	0.14
Carbon	0.20–0.30	0.40–0.50	0.40–0.50	0.40–0.50	0.40–0.50	*	*
Cobalt	Balance	Balance	Balance	Balance	Balance	20.0	13.0
Iron	...	...	...	...	...	Balance	Balance

*Low-carbon type, 0.10 to 0.20; high-carbon type, 0.25 to 0.35

Table 2. Densities and Thermal Expansion Coefficients

Haynes Alloy	Density, Grams per Cubic Cm.	Temperature Range, Degrees F.					
		70-600	70-800	70-1000	70-1200	70-1500	70-1600
		Mean Thermal Expansion Coefficients*					
No. 21	8.2986	7.83	7.96	8.18	8.38	8.68	...
No. 23	8.5385	7.64	7.96	8.18	8.48	9.24	...
No. 27	8.2077	7.53	7.79	8.04	8.29	8.67	8.84
No. 30	8.3137	7.70	7.86	7.91	8.07	8.42	8.54
No. 31	8.6078	...	...	...	...	...	...
N-155 (Multimet)	8.1985	7.96	8.30	8.46	8.58	9.01	...
N-155 (Multimet)†	.....	8.70	8.89	9.10	9.40	9.77	9.90

*Inch per inch per degree F. × 1,000,000 †Low-carbon type

Table 3. Age-Hardening Data

Haynes Alloy	Aging Temp., Deg. F.	As Cast	Length of Aging Period, Hours					
			1	2	5	24	50	100
		Rockwell A Hardness						
No. 21	1350	65	65	66	66.5	68.5	69.5	71.5
	1500	65	67	67	68	69	69	71
	1600	67	69	69	68.5	69	69	70
	1600	64.5	67.5	67.5	67.5	68.5	68.5	68.5
	1700	65	66	66.5	67.5	67.5	68	69
No. 23	1350	65	66	68	69.5	71	71.5	71.5
	1500	..	70	69.5	70	70	69.5	69
	1600	..	68	68	67.5	68.5	69	69.5
	1700	..	68	68	69	69	69	71
No. 27	1350	61	62	66	66.5	67	67.5	67.5
	1500	59	65	64.5	65	65	64.5	65
	1600	59.5	62.5	62.5	62.5	62.5	64	64.5
	1700	61	62	62.5	63	63.5	64	66
No. 30	1500	65.5	69	69.5	69.5	70.5	71	73
	1600	65.5	68	68.5	69	69	70	72
	1700	65.5	67.5	68.5	69	70	70	72
No. 31	1500	64	66	69.5	70	69.5	70	70
	1600	64	66.5	67.5	67.5	67	68	70
	1700	64	67	68	69	68.5	69.5	71
Multimet (Forged) ..	1500	61*	64	63	63	62.5	62	62.5
	1500	61	65	65	64.5	64	63.5	63
Multimet (Forged) .. (Low-Carbon Type)	1500	61†	56	56.5	57	57.5	57.5	59
	1500	61	62	62.5	62	61.5	62	62

*Solution heat-treatment before aging produced a Rockwell A hardness of 60.
†Solution heat-treatment before aging produced a Rockwell A hardness of 56.

velopment of the gas-turbine engine for jet propulsion, cast buckets of the same alloy have been utilized.

The development of high-temperature alloys by the two organizations mentioned has proceeded along two lines—one in the field of casting alloys, the other in the field of wrought alloys. Haynes Stellite alloy No. 21 was used as a starting point for the further development of the high-temperature casting alloys. In the casting alloys, cobalt is used as a base, since it is like iron in many respects. It differs in that it maintains relatively high strength properties at high temperatures, as it resists annealing action.

Since high-temperature resistance to corrosion and oxidation is also a basic requirement, a minimum chromium content of 20 per cent is called for. Nickel is added in some cases to reinforce the action of the cobalt in imparting high strength at high temperatures. Tungsten and molybdenum, important elements which tend to impart still greater strength at higher temperatures, are also used.

The first step taken in modifying the Haynes Stellite alloy No. 21 composition was to reinforce the high-temperature strength by substituting tungsten for molybdenum. This resulted in alloy No. 23, as shown in Table 1. This alloy has about the same endurance strength as alloy No. 21 at 1200 degrees F., but has appreciably greater endurance strength at 1500 degrees F., as shown in Table 4. Its ultimate tensile strength is greater than that of Haynes Stellite alloy No. 21 for temperatures through 1200 degrees F., and is about the same at 1350 degrees F. and above, as shown

Table 4. Endurance Strength

Haynes Alloy	Testing Temperature, Degrees F.	Number of Cycles*	
		100,000,000	250,000,000
		Strength, Lbs. per Sq. In.	
No. 21	Room	35,000 to 40,000	.....
	1200	44,000	.....
	1500	33,000	.....
No. 23	1200	44,000	.....
	1500	38,000	38,000
No. 27	1200	41,000	.....
	1500	31,000	30,000
No. 30	1200	52,000	.....
Multimet (Low-Carbon)	1200	66,000†	.....
	1500	33,000‡	32,000‡
Multimet (High-Carbon)	1500	29,000¶	28,000¶

*Specimens stressed in alternate bending at a frequency of 120 cycles per second
†After aging for fifty hours at 1200 degrees F.
‡After aging for fifty hours at 1500 degrees F.
¶After solution heat-treatment for one hour at 2200 degrees F., followed by water quench and aging for fifty hours at 1500 degrees F.

Table 5. General Physical Properties

Test Temp., Degrees, F.	Haynes Alloy Number					Test Condition of Alloy
	No. 21	No. 23	No. 27	No. 30	No. 31	
Ultimate Tensile Strength, Pounds per Square Inch						
Room	101,300	105,400	82,500	98,100	101,000	As cast
1000	69,100	77,100	50,500	62,900	80,100	As cast
1000	86,200	97,500	.....	.....	.....	Aged 50 hours at 1350° F.
1200	74,200	82,900	48,900	59,900	77,000	As cast
1200	89,300	97,500	.....	.....	.....	Aged 50 hours at 1350° F.
1350	79,300	79,600	66,200	77,800	75,700	Aged 50 hours at 1350° F.
1500	59,000	58,500	51,200	64,000	59,600	Aged 50 hours at 1350° F.
1600	41,600	45,800	41,400	48,900	48,600	Aged 50 hours at 1350° F.
1700	42,500	37,500	43,000	45,200	.....	As cast
1700	.....	43,600	45,400	47,100	.....	Aged 16 hours at 1700° F.
1800	33,300	33,100	33,400	36,300	.....	As cast
1800	32,900	33,000	33,700	37,800	.....	Aged 16 hours at 1700° F.
Yield Strength (Offset 0.2 Per Cent), Pounds per Square Inch						
Room	82,300	58,400	46,900	55,100	74,100	As cast
1000	39,100	41,400	36,600	42,500	40,200	As cast
1000	74,400	72,500	.....	.....	.....	Aged 50 hours at 1350° F.
1200	38,000	40,700	35,000	37,600	37,600	As cast
1200	71,300	74,200	.....	.....	.....	Aged 50 hours at 1350° F.
1350	61,500	63,100	50,800	61,400	53,600	Aged 50 hours at 1350° F.
1500	49,000	40,600	38,200	47,600	44,500	Aged 50 hours at 1350° F.
1600	32,800	33,100	30,800	35,900	36,200	Aged 50 hours at 1350° F.
Elongation, Per Cent in 2 Inches						
Room	8.2	7.0	7.0	5.0	11.0	As cast
1000	16.4	14.8	4.3	6.2	20.0	As cast
1000	1.2	1.7	...	...	...	Aged 50 hours at 1350° F.
1200	15.7	15.6	3.8	6.3	19.0	As cast
1200	2.0	1.8	...	...	...	Aged 50 hours at 1350° F.
1350	3.8	2.0	3.2	1.8	4.6	Aged 50 hours at 1350° F.
1500	6.8	7.8	10.1	3.0	10.3	Aged 50 hours at 1350° F.
1600	19.3	9.8	11.5	9.6	14.3	Aged 50 hours at 1350° F.
1700	27.0	7.0	23.0	17.0	...	As cast
1700	...	18.0	16.0	18.0	...	Aged 16 hours at 1700° F.
1800	35.0	32.0	24.0	24.0	...	As cast
1800	49.0	27.0	26.0	21.0	...	Aged 16 hours at 1700° F.
Reduction in Area, Per Cent						
Room	9.0	11.2	10.3	11.9	14.0	As cast
1000	25.3	24.1	10.3	9.2	33.5	As cast
1000	4.3	4.1	...	...	...	Aged 50 hours at 1350° F.
1200	36.9	21.5	8.0	10.7	28.4	As cast
1200	6.0	6.6	...	...	...	Aged 50 hours at 1350° F.
1350	9.0	6.5	4.6	2.7	7.6	Aged 50 hours at 1350° F.
1500	19.7	12.7	14.4	3.4	14.1	Aged 50 hours at 1350° F.
1600	23.6	16.8	20.1	17.8	18.1	Aged 50 hours at 1350° F.
1700	52.4	35.7	26.5	26.6	...	As cast
1700	...	35.7	34.0	33.3	...	Aged 16 hours at 1700° F.
1800	52.4	40.6	50.3	33.7	...	As cast
1800	63.1	39.5	41.7	38.7	...	Aged 16 hours at 1700° F.
Modulus of Elasticity (Millions)						
1000	33.3	27.9	26.2	25.6	33.5	As cast
1000	35.0	27.6	...	...	...	Aged 50 hours at 1350° F.
1200	33.7	33.5	27.0	27.5	22.8	As cast
1200	23.9	25.0	...	...	...	Aged 50 hours at 1350° F.
1350	24.2	27.0	20.2	24.8	23.9	Aged 50 hours at 1350° F.
1500	16.8	23.5	18.7	25.6	19.3	Aged 50 hours at 1350° F.
1600	15.4	21.9	18.2	17.3	19.0	Aged 50 hours at 1350° F.

in Table 5. The average rupture stress data given in Table 6 indicates that alloy No. 23 is considerably stronger than No. 21 at 1500 degrees F., but at temperatures of 1600 degrees F. and above there are only slight differences in rupture strengths. As shown in Table 3, alloy No. 23 has a hardness comparable to or a little higher than that of No. 21 throughout the aging temperature range.

The next step was to obtain greater toughness at high temperatures by substituting nickel for one-half the cobalt content of Haynes Stellite alloy No. 21. This resulted in alloy No. 27, as shown in Table 1. There was some loss in ultimate tensile strength at lower temperatures, but this is offset by comparable ultimate tensile strengths at temperatures of 1600 degrees F. and above, as shown in Table 5. Alloy No. 27 has a higher rupture strength than No. 21 at 1500 degrees F., but a somewhat lower value at higher temperatures, as indicated by the data in Table 6. The hardness of alloy No. 27 is appreciably less than that of No. 21, as shown in Table 3.

Another alloy—No. 30—was developed, in which only one-quarter of the cobalt in the No. 21 composition was replaced by nickel. This resulted in an alloy that has appreciably higher tensile strengths in the temperature range of from 1500 to 1800 degrees F., as shown in Table 5. Its rupture strength in this temperature range is also higher than that of alloys No. 21, No. 23, and No. 27, as shown in Table 6. The endurance strength of No. 30 alloy at 1200 degrees F. is appreciably higher than that of any of the other casting alloys. As shown in Table 4, this alloy has an endurance strength of 52,000 pounds per square inch at 100,000,000 cycles.

The next step in the casting alloy development was to obtain a better combination of strength and ductility at high temperatures by modifying the No. 23 alloy composition by replacing part of the cobalt with nickel. This gives the No. 31 alloy, as shown in Table 1. As will be seen in Table 5, this alloy has a higher ultimate tensile strength at 1500 degrees F. than alloys No. 21, No. 23, and No. 27, but a substantially lower ultimate tensile strength than No. 30. At 1600 degrees F., however, its ultimate tensile strength is substantially greater than that of alloys No. 21, No. 23, and No. 27, and is comparable to that of alloy No. 30. Its rupture strength at temperatures ranging from 1500 to 1800 degrees F. is appreciably higher than that of any of the other casting alloys shown in Table 6.

In the development of new wrought alloys for high-temperature use, austenitic stainless steel was the starting point. Cobalt and nickel were substituted for a greater part of the iron. The chromium content was raised to a minimum of 20 per cent, and molybdenum, tungsten, and columbium were used to build up high strength at high temperatures. This resulted in the Multimet alloy, commonly called alloy N-155, as shown in Table 1. Incidentally, Multimet has also proved to be an excellent casting alloy.

It will be noted from this table that two alternative ranges of carbon content are indicated. The low-carbon content Multimet alloy has an endurance strength about 50 per cent greater than that of the previously cited casting alloys at 1200 degrees F., and the same endurance strength as alloy

Table 6. Average Stress Required for Rupture

Haynes Alloy	Testing Temperature, Degrees F.	Duration of Stress before Rupture, Hours			
		10	100	500	1000
		Average Stress, Pounds per Square Inch			
No. 21	1200	70,000	51,900	.....	44,200
	1300	54,000	43,000	.....	27,000
	1400	42,000	24,000	.....	15,000
	1500	.....	22,000	15,800	14,200
	1600	.....	16,700	13,400	13,200
	1700	17,000	13,000	10,700	10,000
	1800	12,500	9,400	7,700	7,000
	2000	4,200	.....	.....	.....
No. 23	1500	.....	27,200	22,500	21,800
	1600	.....	16,000	13,000	12,000
	1700	17,000	14,000	12,200	11,500
	1800	12,500	8,600	6,200	5,400
No. 27	1500	29,200	23,400	19,700	18,400
	1600	.....	16,000	12,900	12,000
	1700	16,000	12,000	9,700	8,600
	1800	12,500	9,300	7,500	6,800
No. 30	1500	33,000	28,600	24,100	21,700
	1600	24,200	18,800	15,500	14,800
	1700	19,000	16,000	12,300	11,500
	1800	14,000	10,000	7,900	7,100
	2000	5,500	3,000	.....	.....
No. 31	1500	35,000	28,400	24,600	23,400
	1600	.....	21,000	19,000	18,000
	1700	20,000	17,000	15,300	14,500
	1800	13,000	11,300	10,200	9,800
	2000	6,300	4,000	.....	.....
Multimet (N-155)					
Regular	1500	28,000	21,500	17,500	16,500
Low-Carbon	1500	23,500	18,800	15,000	.....
Modified (Med. Carbon)	1500	27,500	20,500	16,800	14,300
Modified (Low-Carbon)	1500	26,000	19,000	15,000	13,000
Hot-Worked and Aged (Low-Carbon)	1500	.....	20,000	14,500	12,500
Modified Hot-Worked and Aged (Low-Carbon)	1500	29,000	22,000	18,000	16,500

No. 21 at 1500 degrees F., as shown in Table 4. The high-carbon Multimet alloy has substantially less endurance strength at 1500 degrees F. than the low-carbon composition.

Also shown in Table 1 is a modification of the Multimet alloy, known as N-153, in which the percentages of the various alloying elements have been decreased slightly, while the iron content has been increased. This gives a lower-cost wrought alloy, suitable for use at lower temperatures than the N-155 alloy.

The rupture strength values given in Table 6 for the regular, the modified medium-carbon, and the modified hot-worked and aged low-carbon Multimet alloys show that, at 1500 degrees F., all three are superior to Haynes Stellite alloy No. 21 for a 500-hour stress period, and two of them are superior for a 1000-hour stress period. They do not compare favorably with the other cast alloys, however. The values for the other Multimet alloys given in this table indicate that they have definitely less rupture strength at 1500 degrees F. for these two stress periods.

Another alloy, Hastelloy B, which was developed before the war, has been found suitable for high-temperature applications. It is now being used for the blades of gas turbines in jet-propulsion airplanes.

Gas-turbine developments for aircraft, marine, and stationary power applications have stimulated further research in the field of high-temperature alloys. Basically, the problem is to develop alloys that exhibit high-temperature strength, together with corrosion and oxidation resistance, over a relatively long service life, as compared with the short service life requirement of, say, a few hundred hours, called for in wartime applications.

It is of interest to note that as the temperature of the wrought alloys approaches that normally required for forging, they rapidly lose strength. On the other hand, it is anticipated that future temperature requirements will be raised still further, since, for example, the efficiency of gas turbines rises rapidly as their operating temperature increases. Consequently, it may be expected that the field for future development of high-temperature alloys will shift more and more to the investigation of new casting alloy compositions.

Research work is being actively engaged in by the Union Carbide and Carbon Research Laboratories, Inc., in cooperation with the Haynes Stellite Co., to find even better metals for high-temperature applications and to make available better methods of fabricating these alloys into the parts required.

* * *

If a company pays out in wages—or in dividends for that matter—money that it should plow back into the business instead, that company is headed for bankruptcy, and its employes will be out of jobs. And if a company pays so much out in wages that it cannot meet the prices of its competitors, the result is identical.—*George T. Trundle, Jr.*

A Good Navy Public Relations Job

At the Navy's invitation approximately eighty representative members of the machine tool industry and three or four members of the business press were guests last month aboard the aircraft carriers *Midway, Princeton,* and *Franklin D. Roosevelt* on a cruise from New York to Norfolk. The better part of two days was spent aboard the ships, during which time the machine tool builders were afforded every opportunity to look over the complicated mechanisms, get some idea of what it takes to make these huge fighting machines function, and see the way they are handled under actual operating conditions.

The cruise in this way gave a large number of top-ranking machine tool executives a better understanding of the Navy's job and the importance of the Navy equipment which had been produced directly or indirectly by their machines. There is no doubt that future machine tool orders destined for the U. S. Navy, either ashore or afloat, will have a greater significance and receive more personal attention from the top men in the machine tool industry than would have been the case before this cruise took place.

A stimulating and impressive experience to all those who took part, it was a smart and constructive piece of public relations work, carried out with a high degree of efficiency both by the Office of Public Relations of the U. S. Navy and personnel of the ships concerned.

* * *

Safety Code for Industrial Use of X-Rays

The American Standards Association has recently completed a Safety Code for Industrial Use of X-Rays, known as No. Z54. Copies of this code are available from the American Standards Association, 70 E. 45th St., New York 17, N. Y., at the price of $1.50.

The code covers six parts: Part I is a general section on the installation, operation, use, and maintenance of industrial X-ray equipment. Part II covers the use and storage of radium in the field of industrial radiography; Part III, the methods and materials of X-ray protection; Part IV, the specific applications for 400 kilovolts and lower; Part V, X-ray protection for voltages of one and two million; and Part VI, electrical protection.

* * *

Gearing Industry Continues to Show Increase

The American Gear Manufacturers Association reports that the gearing industry shows an increase in volume of sales for April, 1946, of 3 per cent, compared with March, 1946. These figures do not include turbine or propulsion gearing. The index figure for April was 284.

Editorial Comment

It has been estimated that in the production of 1,000,000 automobiles are used the crops from more than 500,000 acres of land; the hides from 30,000 head of cattle; the mohair from 87,500 goats; the wool from 800,000 sheep; and the lumber from 25,000 acres of forest land.

How far-reaching are the effects of industrial activity on employment! When more is produced of anything, there is more employment created in many different fields of work—in fields vastly removed from those of the industry itself. Mass production of automobiles was made possible by improved machinery and methods, and the automobile, in turn, has increased employment on farms and in forests, which are the sources of many of the materials used in automobile production. The men who by strikes or other means stop the wheels of progress are responsible for unemployment in many fields far removed from those immediately affected.

Industrial Progress Starts Endless Chain of Activity

▼ ▼

Several manufacturers have pointed out that one effect of labor union seniority rules in the machine shop industry is to reduce the over-all efficiency of the working force. Owing to the cancellations of war material orders, it was obviously necessary in many plants to lay off a considerable number of men. Ordinarily, in accordance with good management procedure, the most capable men would be kept, whereas those who showed no interest in, nor any great capacity for, their work would be laid off. This is not possible under the seniority rules.

Seniority Rules Work Hardship on Able Young Men

Many young men who have entered manufacturing plants recently and who have proved themselves not only well adapted to machine shop work, but energetic and interested in this occupation as well, had to be laid off because they were hired more recently than other men of mediocre ability hired at an earlier date. It is easy to imagine the effect on a young man who has done his very best and who knows that he has filled his place to satisfaction, when he loses his job, while men who he knows are not worth as much as he is, are being retained. It is discouraging for a young man to put forth his best effort when this is his reward; and it certainly cannot be said that labor unions are encouraging a man to do his best by such rules.

One may have the highest regard for the good work that many labor unions have done. Without them there is no question but that labor would not have advanced to the high level it now occupies in a great many industries. Granting this, however, does not call for approval of such union rules and featherbedding practices as make for inefficiency, stifle ambition, and discourage honest effort; and don't let it be overlooked that any rules or methods, whether instituted by management, unions, or the Government, that put a damper on individual initiative decrease production and thereby reduce the standard of living for everybody.

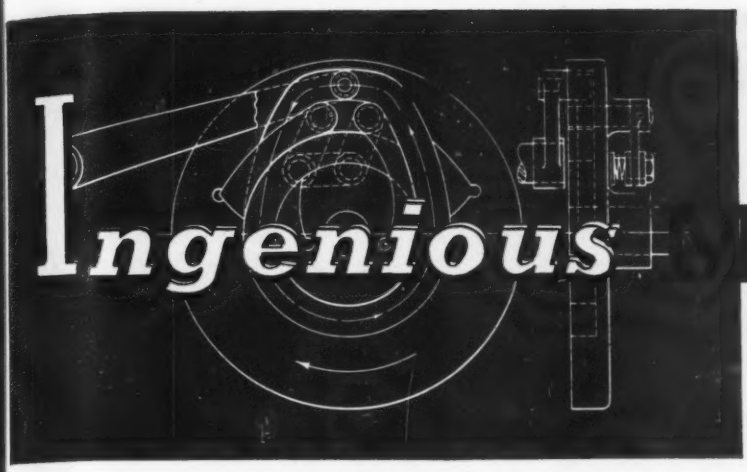
When there is More Produced, there is More to Share

A high standard of living is not promoted simply by higher wages in dollars and cents and shorter hours; a higher standard of living can be obtained only through increased production by each individual. The more there is produced, the more there is to share.

▼ ▼

Recently a well-known radio commentator said that it looked as if we had adopted in this country all the bad features of the Russian industrial system—dictatorship over industry, price control, Government planning, restraint of free enterprise and the initiative of the individual, and controls over the freedom of action of both workers and job creators. On the other hand, he said, Russia has adopted some of the good features of the free enterprise system under which America developed the highest standard of living in the world—such features, for example, as payment for work performed according to production or results; the recognition of duties, as well as rights, on the part of those engaged in industry, whether as workers or managers; and the expectation that each individual should return an equivalent for what he receives. He raised this question: What is likely to happen if we continue to adopt the bad features of the Russian system, while the Russians adopt more and more of the good features of the American free enterprise system?

Shall We Continue to Adopt This Kind of Foreign Ideas?



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Spindle-Control and Collet-Operating Mechanism for Screw Machines

By A. W. JANSSON

The feeding of irregular-shaped automobile parts into the work-holding collets of a special multiple-spindle screw machine necessitated the provision of some means for automatically stopping the rotation of the spindles in exactly the same angular position at the loading station, opening the collet to receive the work, closing the collet on the work, and releasing the spindle-driving clutch. The unique mechanism developed to perform these functions consists primarily of a three-ball type spindle stopping and starting clutch and a collet opening and closing device, arranged as shown in Fig. 1. Details of the principal members are shown in Figs. 2, 3, and 4.

The spindles of the machine are all housed in a rotor *A*, Fig. 1, operated by a Geneva motion indexing mechanism. A center gear (not shown) which engages the pinions *E* serves to drive all the spindles. The collets are closed by the action of a stiff helical spring *S*.

This arrangement left little space for the spindle clutch, which was required to be of very compact design. Referring to the assembly view of the spindle, Fig. 1, the rocker arm *B* opens the collet by moving rod *C* to the right, causing spring *S* to be compressed. The spindle *D* is driven by the pinion *E*, which is bored out to house clutch ring *F*.

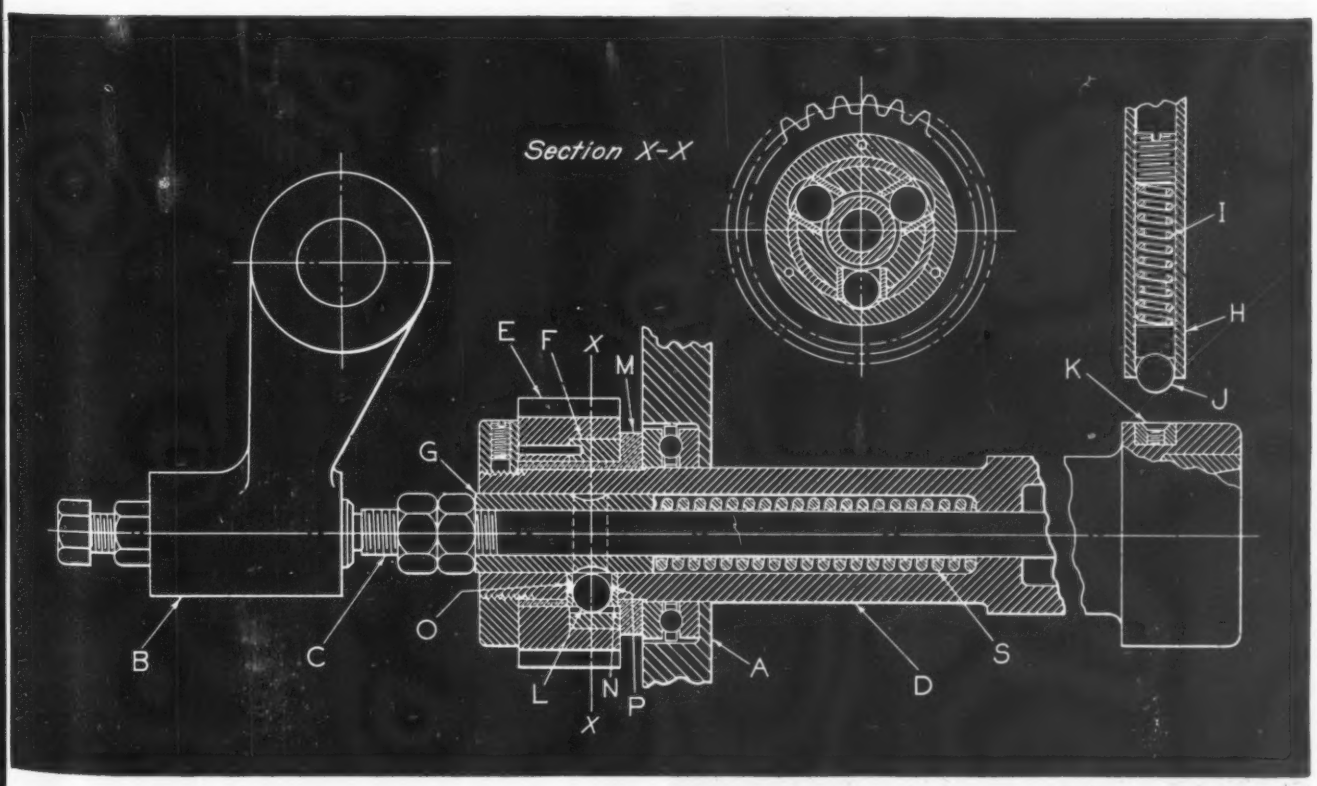


Fig. 1. Mechanism Designed to Automatically Start and Stop Rotation of Spindle D and Open and Close Its Work-holding Collet at the Loading Station of a Multiple-spindle Screw Machine

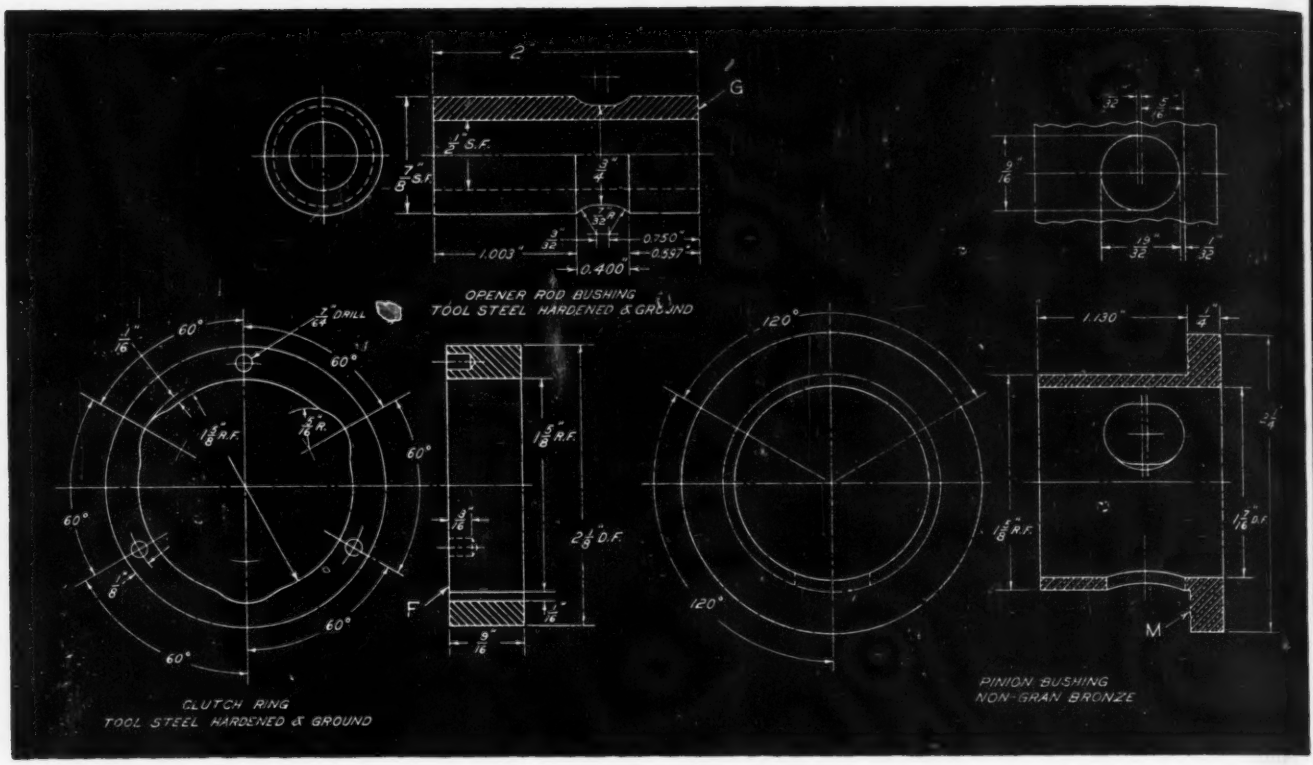
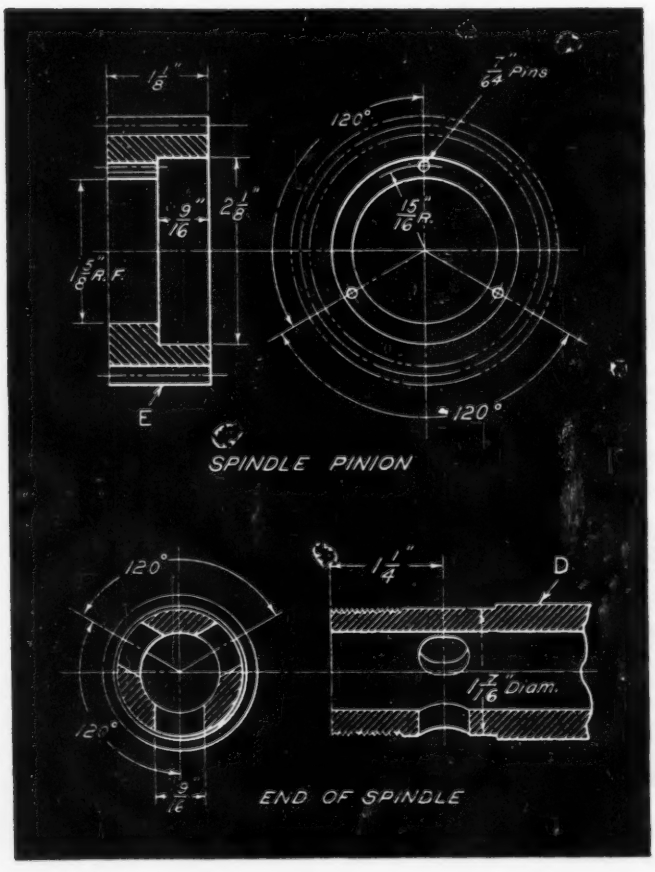


Fig. 2. (Above) Details of Collet-opening Rod Bushing G, Clutch Ring F, and Pinion Bushing M of Mechanism Shown in Fig. 1

Fig. 3. (Below) Details of the Spindle Pinion E and the Driven End of Spindle D, Fig. 1



The clutch ring is a drive fit in pinion *E* and is pinned to it, so that members *E* and *F* comprise an assembled unit. This unit runs continuously at a speed of 900 R.P.M. during the operation of the machine.

Three holes are drilled and bored through pinion bushing *M* to receive the bushings *N* which house the steel balls *L* of the clutch engaging and disengaging mechanism. These bushings are spaced 120 degrees apart, and are a drive fit in the bored holes. Bushings *N* have a slot for holding spring *O* (see Fig. 4). A 5/64-inch hole *P* is also drilled in the bushing to form a retaining seat for the ball *L*.

The bushing *G*, Fig. 1, which is employed to guide the collet-opening rod *C*, is also used for operating the spindle clutch. The tube *H* at the front end of the spindle rotor carries a spring *I* and ball *J*. The end of tube *H* is machined to prevent ball *J* from falling out of the tube. The hardened cup *K* in the spindle *D* is threaded to facilitate its removal when necessary. Tube *H* is moved downward by a cam device when the spindle clutch is released, so that the ball *J* is forced into the cup *K* to stop the spindle. Thus the spindle is always stopped in the same position with respect to the rotor *A*, so that the work, in turn, can be fed into the collet in the correct position. This requirement presented a rather difficult problem, since the spindle runs at a speed of 900 R.P.M. A clutch made up for testing purposes was operated successfully at a speed of 1200 R.P.M. before the design was incorporated in the mechanism described.

In the assembly shown in Fig. 1, the 7/16-inch ball *L* at the bottom position is shown resting in the 5/16-inch radius cut-out in clutch ring *F*. The ball remains in this position only momentarily,

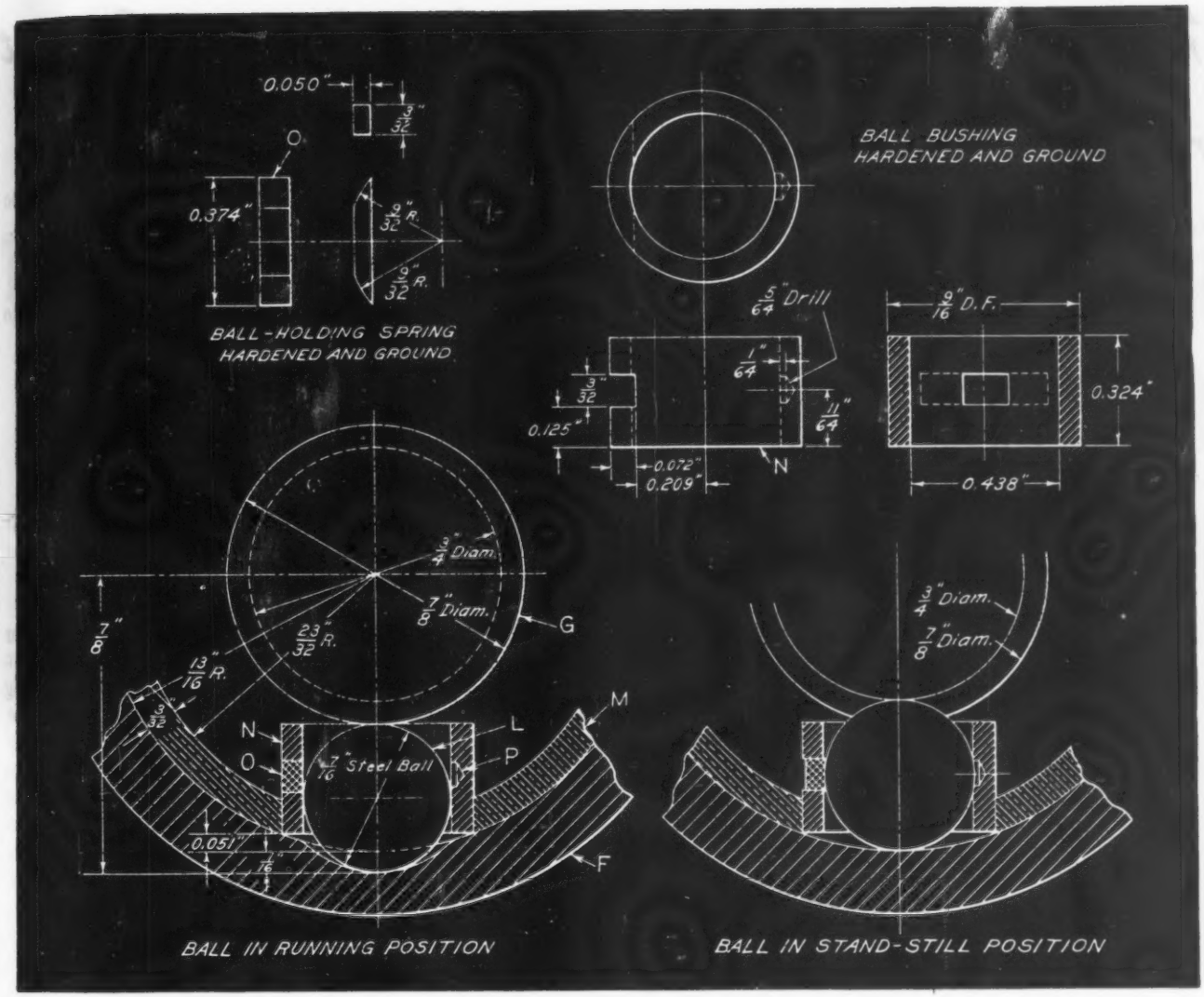


Fig. 4. Enlarged-scale Views of Details N and O, Fig. 1, and Broken Section Views Showing Spindle Clutch Balls L in Running and Idle Positions

however, since rotation of clutch ring *F* brings the cylindrical 1 5/8-inch diameter section of the latter member into contact with the three balls, forcing them inward toward the center of the spindle, where they are held by spring *O* and depression *P*.

The two enlarged views in Fig. 4 show exactly how the ball is located both in the running and in the standstill position. When arm *B*, Fig. 1, swings to the left, the draw-rod *C* closes the collet, and the three 7/16-inch balls are forced outward, so that they come in contact with the bottom of the 5/16-inch radius cut-outs in the clutch ring *F* and thus start the spindle rotating. When arm *B* swings to the right, the channel in the bushing *G* clears the three balls, causing the spindle to stop and the collet to open.

* * *

In one month of regular broadcasting a giant radio broadcasting tube generates heat equivalent to that supplied by a ton of hard coal. The surplus energy is utilized to heat the building in which the transmitter is housed.

Westinghouse Awards Scholarships

Ten seniors in high schools throughout the United States have been awarded George Westinghouse scholarships by the Westinghouse Electric Corporation, Pittsburgh, Pa. The awards are valued at $1850 each, and are to be applied toward a course in engineering at the Carnegie Institute of Technology. Four summers and one full year in the Westinghouse shops and laboratories with regular pay augment the educational and monetary worth of the scholarships. Awards to winners who enter the armed services will be held, provided they begin their engineering studies within one year of their release.

* * *

The coal mine and railroad strikes have paralyzed this country in a manner that no other cause or natural disaster in war or peace has ever done before. The material losses to our entire population are enormous. The lost time can never be retrieved.

Prize Winners in Ingenious Mechanism Contest

THE cash prizes offered in the February number of MACHINERY for the eight best articles dealing with ingenious mechanisms submitted to the Editor before May 1 resulted in the receipt of an impressive number of entries. The judges have awarded the prizes as follows:

Two Hundred Dollar Prize

"Rotating Disk-and-Pin Mechanism for Controlling Cutter-Head Slide of Automatic Cam-Generating Device"

By Charles Golosman, Brooklyn, N. Y.

One Hundred Dollar Prize

"Spindle-Control and Collet-Operating Mechanism for Screw Machines"

By A. W. Jansson, Orrville, Ohio

Fifty Dollar Prizes

"Power Feeding Mechanism Controlled by Resistance to Band Saw Blade"

By William F. Ocenasek, Plainfield, N. J.

"Device for Cutting an Accelerating Twist in Gun Rifling"

By George Tonn, Elmhurst, Ill.

Twenty-Five Dollar Prizes

"Device for Automatic Shifting between Two Cam-Operated Feeding Mechanisms"

By H. B. Schell, Brooklyn, N. Y.

"Fine Feeding Mechanism Adjustable from 1 to 50 Microns per Revolution"

By Bernard J. Wolfe, Rochester, N. Y.

"An Automatic Variable-Lift Cam"

By L. Kasper, Philadelphia, Pa.

"Mechanism for Interrupting a Feeding Device at Adjustable Predetermined Positions"

By Charles F. Smith, Fairfield, Conn.

These prize-winning articles, as well as all other accepted contributions to the Contest, will be published in our Ingenious Mechanisms section during the coming months. This section, which, since June, 1927, has been a regular monthly feature of MACHINERY, is invaluable to machine designers, as it includes articles concerning some of the most effective motions ever devised. The mechanical principles described can often be applied in designing automatic machines and other mechanical devices differing widely as to type and purpose.

Increasing Application of Aluminum

WITH the aluminum production capacity in the United States twice the total world consumption in 1939, the nation's aluminum industry is putting into effect intensified sales campaigns to promote the greatest possible use of the metal. Aluminum emerged from the war a better metal for many new purposes, and is now available at the lowest price in its history.

Among the many new applications may be mentioned new types of roofing sheet being introduced in the building industry. The nation's railroads seeking lighter equipment are specifying aluminum for many applications. Of the 1100 railroad passenger cars on order at the end of the year, 160 are to be of all-aluminum construction and the others will contain aluminum averaging between 2000 and 10,000 pounds per car. Even locomotives will employ larger amounts of the light metal. The Pennsylvania Railroad has 50 new locomotives under construction which will employ, on an average, 10,000 pounds of aluminum each for cabs, walkways, boiler covering, etc. Among smaller items already in volume production may be mentioned a line of aluminum canoes weighing one-half to one-third as much as similar types in other materials.

The new high-strength alloy 75S, introduced during the latter months of the war for aircraft construction, will occupy an important place among standard peacetime alloys. It has a tensile strength exceeding 80,000 pounds per square inch, and is the strongest aluminum alloy of its type thus far developed. The automotive industry is using aluminum increasingly in trucks and trailers.

Significant progress has also been made in the fields of welding, brazing, and resin-bonding of aluminum, all of which processes will have their influence on the fabrication of post-war aluminum products.

Developments in the field of aluminum finishes continue at a rapid pace. The Alumilite process has been further perfected, and peacetime customers of aluminum will find the metal finished in practically every color of the rainbow.

Commercial electroplating of aluminum is now practicable. Nickel, copper, silver, chromium, and gold platings can be applied to aluminum by the use of a zinc immersion procedure. Gold-plated aluminum will be available for novelty articles and for jewelry; nickel-plated aluminum is suitable for many classes of hardware.

Tool Engineering IDEAS

Helical Cutter with Adjustable Blades

By CHARLES F. SMITH, Fairfield, Conn.

A helical cutter with blades that can be adjusted to permit regrinding or sharpening to the original diameter is shown diagrammatically in Fig. 1. A cutter of this type was designed, patented, and used by the writer many years ago for cutting envelopes from a roll of paper. The patent on the cutter has expired, however, and anyone who so desires can now make use of the design for any cutting or milling operation for which it can be adapted.

The twelve blades *A*, mounted on six holders *B* like the one shown in Fig. 2, can be adjusted outward tangentially by means of back-up screws *C*. After adjustment, the blades can be clamped securely in place by cap-screws *D* to permit regrinding to the original diameter. This feature also permits the cutters to be adjusted for grinding to either larger or smaller diameters within certain limitations.

Instead of having the helical cutting edge *E* ground for such operations as milling a flat surface, the adjustable blades can be form-ground for profile milling operations, with the advantage that the blades can be reset and reground to restore the cutter to its original size and form. Only one of the six cutter and holder assemblies is shown in full lines in Fig. 1, the positions of the remaining five being indicated by dotted lines.

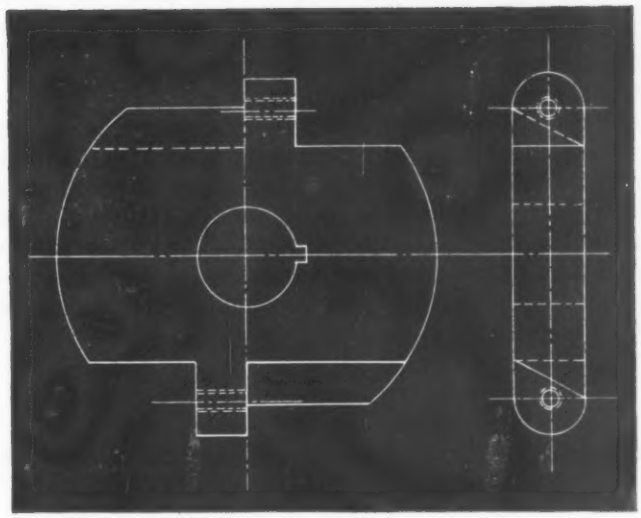


Fig. 2. One of the Six Cutter-holders B Shown in Fig. 1

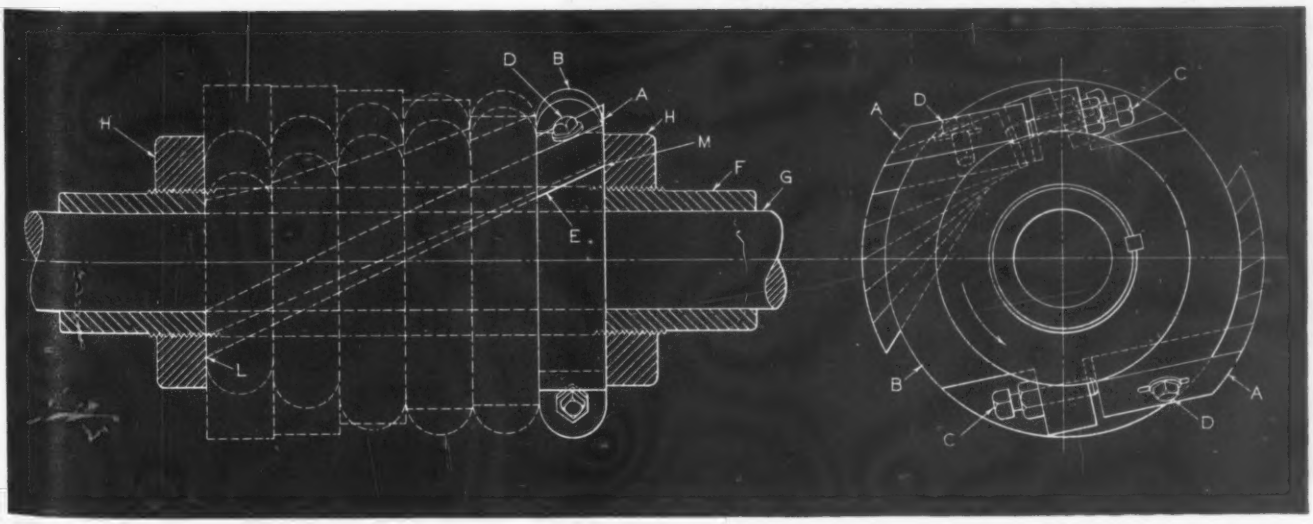


Fig. 1. Diagrammatic Views of Milling Cutter with Two Helical Blades, Each Consisting of Six Adjustable Blades A

In making the holders *B*, disks of the required diameter and thickness for these members are keyed to the sleeve *F*, mounted on arbor *G*, and held in place by nuts *H*. The assembled disks are then mounted on a milling machine set for milling a light helical line, which is used for locating purposes in machining the seats for the cutter blades in the correct positions and at the correct angle. The latter operations are performed separately on each cutter-holder after the holders are removed from the arbor.

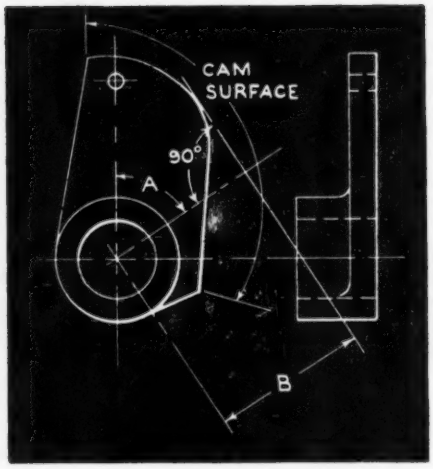


Fig. 1. Cam that is Quickly Duplicated by Means of the Simple Set-up Shown in Fig. 2

When the holders have been completely machined, including the drilling and tapping operations, and the blades have been secured in place, the entire assembly is again mounted in the milling machine and a helical cut or cuts taken along the cutting edges of the blades to obtain a true continuous helical cutting edge from the point *L* to the point *M*. The cutter blades can then be removed and hardened. After reassembling on the holders, the hardened cutters can be finish-ground.

Simple Method of Duplicating Cam Surfaces on a Surface Grinding Machine

By FRITZ L. KELLER, Bloomfield, N. J.

A quick and simple method of duplicating cam surfaces on a surface grinder is described in the following. Cams such as shown in Fig. 1 were formerly produced in small quantities by grinding each cam, step by step, in more than forty positions, each position at a different distance *B* from the center of the cam and at a different angle *A*. This was a slow process, and the chances of making errors were great. Now the cam surfaces are duplicated from a master cam by means of the set-up shown in Fig. 2.

This set-up consists essentially of a simple fixture *F*, mounted on the magnetic table of a surface grinding machine. This fixture holds the master cam *M* and a work-piece *W* by means of a pilot stud *P*, which may be seen clearly in Fig. 3. A locking pin *L* insures that the position of the work-piece is in proper relation to the master cam. The U-washer *U*, placed between the work-piece and the head of the clamping screw *D*, facilitates quick loading and unloading of the work.

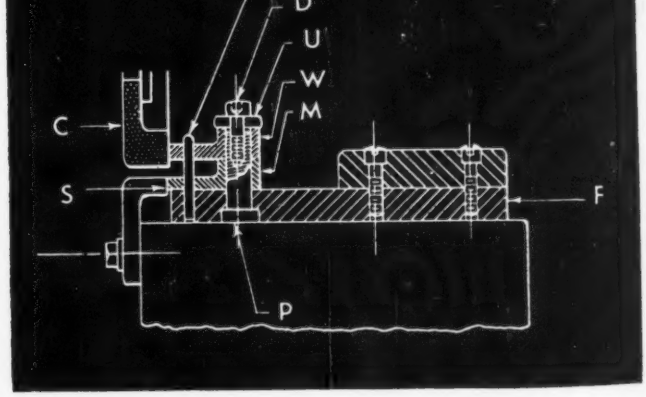


Fig. 3. Cross-sectional View of the Cam Surface Duplicating Set-up Shown in Fig. 2

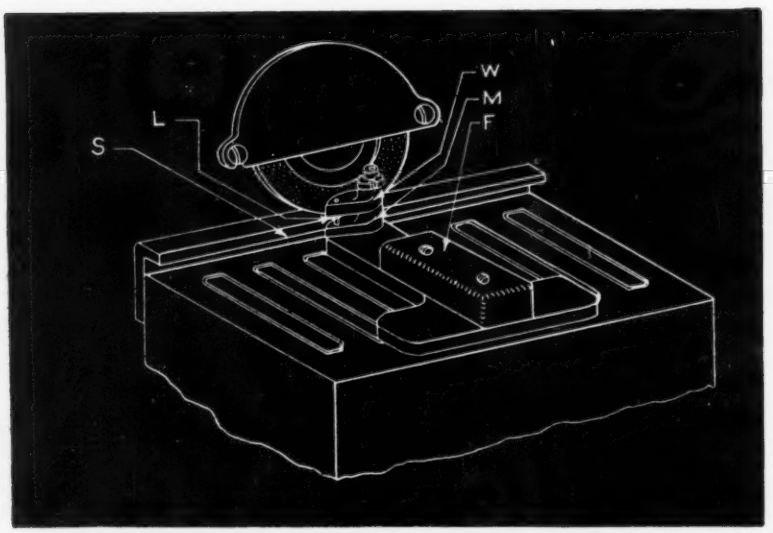


Fig. 2. Fixture F is Mounted on the Table of a Surface Grinding Machine to Grind Work-piece W to the Contour of Master Cam M

After clamping the master cam and the work-piece to the fixture, the work is gradually pressed against the cup-shaped grinding wheel *C*. Movement toward the grinding wheel is limited by the master cam coming in contact with the stop *S*, which is fastened to the table of the grinding machine. By oscillating the fixture, the excess stock is ground from the work-piece to conform with the shape of the master cam. The table of the grinding machine must be demagnetized to permit the free movement of the fixture.

The work should not be fed toward the grinding wheel too rapidly or discoloration of the cam surface from the

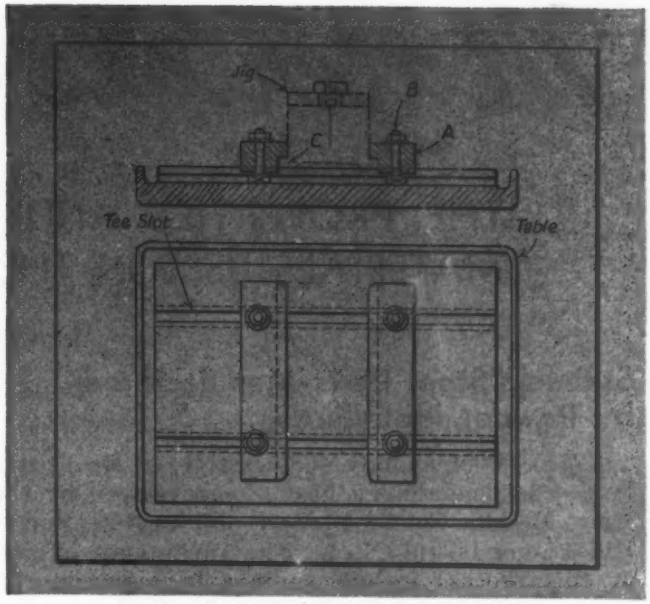
excessive heat will result. The use of coolant will allow faster feeding, with resultant increase in production. Care must be taken to see that the face of the cup-wheel is dressed exactly flush with the edge of the stop *S*.

Slides for Holding Drill Jigs to Table

Considerable trouble is experienced in performing drilling operations when the jig is lifted from the machine table by the rotating drill. Often the jig is rotated until the machine is stopped. This generally results in damage, not only to the drills but also to the machine spindle, work and jig. To overcome this, a pair of table slides *A* was designed to hold the jig down, as shown in the accompanying illustration.

The slides are fitted to the T-slots on the machine table and secured to the table by bolts *B*. A groove *C* on the inside of each slide corresponds with the projections on the jigs to be used.

For an operation, the jig is passed between the slides from the front after the slides have been set for accurate alignment of the jig with the drill spindle. This not only prevents the jig from being lifted from the table during the drilling operation, but also facilitates sliding the jig into the correct drilling position.



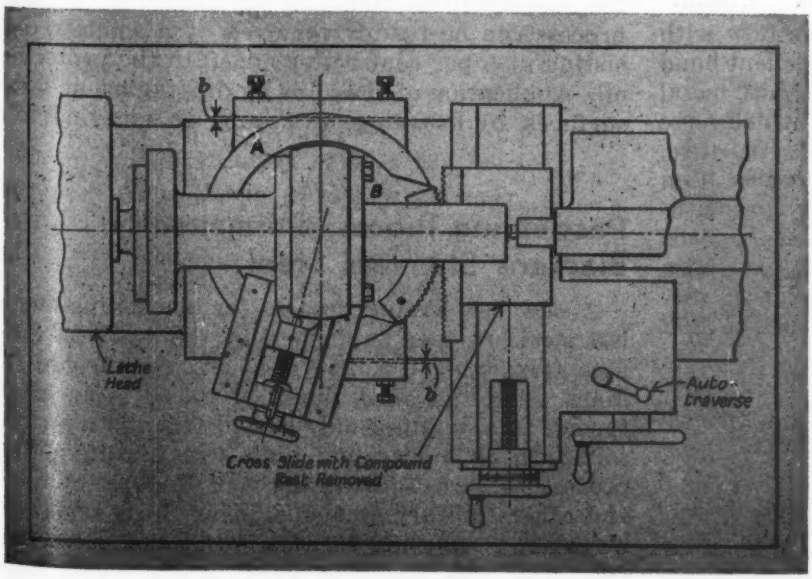
Drilling Machine Table Equipped with Slides A for Holding Jigs

Lathe Set-Up for Spherical Turning

A spherical turning set-up with a simple method of feeding, devised for use on a lathe, is shown in the accompanying illustration. The fixed base *A* of the rotary table *B* is secured to the bed of the lathe by plates provided with clearances, as indicated at *b*, which permit adjusting and clamping by means of four set-screws. The center of the rotating table is provided with a vertical locating pin of a size corresponding with a hole in a standard mandrel, which is mounted between the centers of the lathe for use in centralizing the rotating table before clamping the fixed base *A* to the lathe ways by means of the four set-screws.

The gear segment on the rotating table *B* engages a rack attached to the cross-slide of the lathe, from which the compound rest has been removed. Swiveling of table *B* as required for the spherical turning operation is accomplished by turning the cross-slide handwheel. The depth of cut can be adjusted by turning the handwheel on the feed-screw of the tool-rest located on the rotary table.

With the set-up shown, the work is rotated by the lathe spindle while the tool mounted on table *B* is swung about the center of the work by means of the cross-slide handwheel.



Spherical Turning Attachment with Simple Method of Feeding, Devised for Use on a Lathe

* * *

A few industries have been able to avoid the worst penalties of restrictive labor practices because total labor costs represent a small proportion of total costs. By improvement in operating methods, including superior mechanization, costs to the consumers in some instances can be reduced despite labor's tendency to restrict output. The railways of America afford a classic example. But railway rates could be lower and the national economy could be greatly accelerated if railway labor would abandon restrictions.—*Louis Ruthenburg*

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Stainless-Steel Parts Manufactured by Powder Metallurgy

A process of manufacturing stainless-steel parts by powder metallurgy has been developed by the Micro Metallic Co., 99-16 Metropolitan Ave., Forest Hills, Long Island, N. Y. The advantages offered by this process include savings in raw material costs, elimination or reduction of machining, and mass production at low unit cost. As compared with powdered-metal parts of other metals and alloys, stainless steel offers a number of important advantages, in addition to corrosion resistance. One of these is high strength, coupled with ductility (55,000 to 65,000 pounds per square inch tensile strength and 10 per cent elongation), a most unusual combination for powdered-metal parts.

The process is well adapted for making machine parts where corrosion resistance or self-lubrication is an advantage or where a combination of high strength and ductility is desired. Products made of this material are readily polished to a high finish. 201

Cleaning Process that Facilitates Bonding of Meehanite to Babbitt

A recently developed method of cleaning Meehanite bearing shells, known as the "Kolene" process, results in a chemically clean surface with no free graphite particles, so that an excellent bond between the Meehanite shell and the babbitt metal is obtained. Using Meehanite castings, which have high strength properties, dense metal structure, and uniform physical characteristics, it has been possible to produce bearing shells that have withstood more severe service than steel-backed shells with the same type of babbitt. It has also been found that lead-arsenic babbitt can be used successfully in these bearings with lower cost. ...202

Reinforced Plastic Resin Tested for Tooling Jigs

A thermosetting plastic resin known as "BCM" that has excellent bonding properties and high resistance to heat has been developed by E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. This resin, reinforced with glass fabric or other materials, is being tested for use in tooling jigs and also for structural panels in automobiles, airplanes, refrigerators, and washing machines. Although used chiefly with glass fabric laminates at the present time, this resin can also be applied to paper, hemp, wood, and various cloths. It requires only a short curing period and low laminating pressure, and can be used as an impregnating and laminating resin either by itself or mixed with polymer. 203

Protective Oil Used as Drying Agent and Rust Preventive

A special protective oil for preventing the rusting of ferrous surfaces between fabricating operations and while parts are in storage has recently been announced by Oakite Products, Inc., 26 Thames St., New York 6, N. Y. The oil imparts a thin transparent rust preventive coating that does not interfere with accurate gaging, nor does it stain or discolor ferrous surfaces. Because of its ability to both absorb and displace water, this oil may be used for drying ferrous parts after hot alkaline tank cleaning and cold water rinsing. It also offers the advantage that small flat parts treated with this oil do not stick together.

Fingerprints or similar marks resulting from the inspection or handling of machined work in process can be readily removed by a solution consisting of 5 per cent water added to the protective oil. Application of the oil is by dipping or, on large surfaces, by brushing, swabbing, or spraying..204

Passivating Process Permanently Blackens Stainless Steel

A new passivating process for blackening stainless steel has been announced by the Stainless Surface Hardening Co., 255 Bent St., Cambridge 41, Mass. The dull black finish produced is an oxide formed to a depth of only 0.00001 inch in a molten salt bath at moderately high temperature. The process was used during the war on parts of rifles and other military weapons. The finish remained black after exposure to heat, sun, sand, mud, and rain, and was found to improve the well-known corrosion resistance of the stainless steels to which it was applied. 205

To obtain additional information on materials described on this page, see lower part of page 236.

Color Parkerizing Increases Corrosion Resistance of Iron and Steel

A chemical immersion process that imparts colors to Parkerized iron and steel surfaces and also increases the corrosion resistance of the coating has been introduced by the Parker Rust Proof Co., Detroit 11, Mich. "Color Parkerizing," as the process is called, imparts a phosphate coating by chemical reaction which is integral with the surface of the metal, is insoluble in water, does not smudge, chip, or peel, and retards the spread of corrosion from any abraded areas. As the ordinary Parkerized surface is not appreciably built up by this process, it can be applied to threaded or assembly parts. Gray, blue, purple, green, and olive drab colors are obtainable. With the exception of the gray color, there is some fading upon exposure to sunlight.

The colored coating is applied by immersion in a boiling solution, and no electric current is used. The work may be immersed directly into the color bath after Parkerizing and rinsing. Immersion periods usually vary from two to six minutes; then the work is rinsed and dried.

Springs of similar sizes but of different tension or composition, screws having different threads or lengths, and other products similar in appearance, but different in application, can be easily identified by applying different colors to them. Many applications that have required electroplating or rustproofing, in addition to painting, can now be treated simply with color Parkerizing. 206

Flexible Diaphragm Cloth Resists Temperature Change

Of particular interest to pump and diaphragm manufacturers is the new 80/80 base Style DL-011 diaphragm cloth now being made by the Irvington Varnish & Insulator Co., 6 Argyle Terrace, Irvington 11, N. J. In addition to having good mechanical strength, it is claimed that this cloth retains its flexibility and is practically unaffected by relatively wide temperature changes.

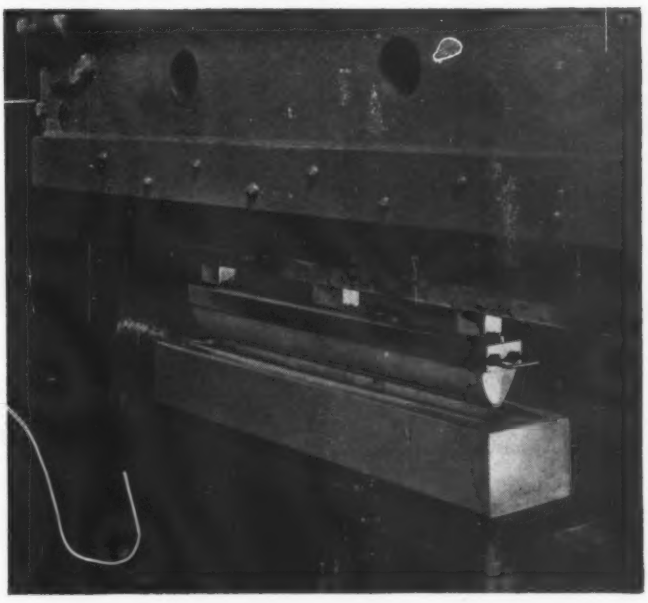
The new diaphragm cloth was developed primarily for use in the automotive field, but is also recommended for applications where strength, flexibility, and resistance to changes in temperature, as well as to the action of certain solvents, are important considerations. 207

Silicone Compound Prevents Foaming of Aqueous Solutions and Emulsions

Another silicone product called "DC Antifoam A," is now being produced by the Dow Corning Corporation, Midland, Mich., to prevent foaming in chemical processes and industrial operations. This new compound eliminates or reduces the foaming of various aqueous solutions even when they are subjected to steam distillation or vacuum concentration. It is effective in concentrations ranging from one part in 10,000 for strong foamers to one part in 1,000,000 for weak foamers.....208

High-Conductivity Copper Casting Alloy for Electrical Use

The need for copper castings of higher conductivity than are usually available has been met by the introduction of Ampcoloy 90, a product of Ampco Metal, Inc., Milwaukee 4, Wis. This alloy, which is designed for electrical use, has a minimum guaranteed electrical conductivity of 90 per cent. Average conductivities are considerably higher, and values ranging up to 98 per cent have been obtained. It is recommended for use in making transformer secondaries, cable attachments, electrode-holders for arc furnaces, electrical contacts, and castings for resistance welding machines..209



Both Members of This Die Set were Made of Durez Casting Resin. After Turning out Hundreds of 24-gage Aluminum Reflectors on a Power Brake, No Signs of Die Wear were Evident. Consistent Smoothness of the Reflector Surfaces was Maintained

To obtain additional information on materials described on this page, see lower part of page 236.

Gisholt Two-Element Unbalance Measuring and Correcting Equipment

Balancing Equipment that Records the Amount of Unbalance in Automotive Crankshafts and Automatically Transmits the Recorded Information to a Multiple Drilling Machine which Drills Holes in the Crankshafts to the Depth Required to Effect Balance

AN entirely new type of semi-automatic equipment for measuring and simultaneously correcting unbalance in automotive crankshafts has been developed by the Gisholt Machine Co., Madison, Wis. The equipment consists of two electrically connected machines. The first of these machines is a Gisholt Type C Dynetric balancing machine; the second is a multiple-spindle drilling machine. The new equipment provides a means whereby the entire balancing process can be completed on automotive crankshafts to a high degree of accuracy, with a minimum of physical and mental effort and with a minimum possibility of human errors.

It is common practice to balance a rotating part by adding or removing weight in each of two planes perpendicular to the rotational axis. On a direct-current armature, the banding wires provide two such planes where solder may be added to make the necessary corrections for balance. On a squirrel-cage fan, the shroud rings provide two planes of correction which are perpendicular to the rotational axis. In both these examples, corrections for balance may be made in each of the planes through 360 degrees of arc. In crankshafts, it is generally impossible to find two planes of corrections perpendicular to the rotational axis where balancing corrections can be made through 360 degrees. Actually, only a few points are available on a crankshaft where metal can be removed to provide balance. Common correction points in a crankshaft are in the crankpins and in the counterweights.

Generally, the balancing machines available for measuring unbalance effects in crankshafts are of a universal type, which provide for measurement of the amount and angular location of unbalance in each of two planes perpendicular to the rotational axis. By the use of charts or by trial and error methods, the balancing machine operator determines the amount of metal which should be removed from the correction points in the crank-

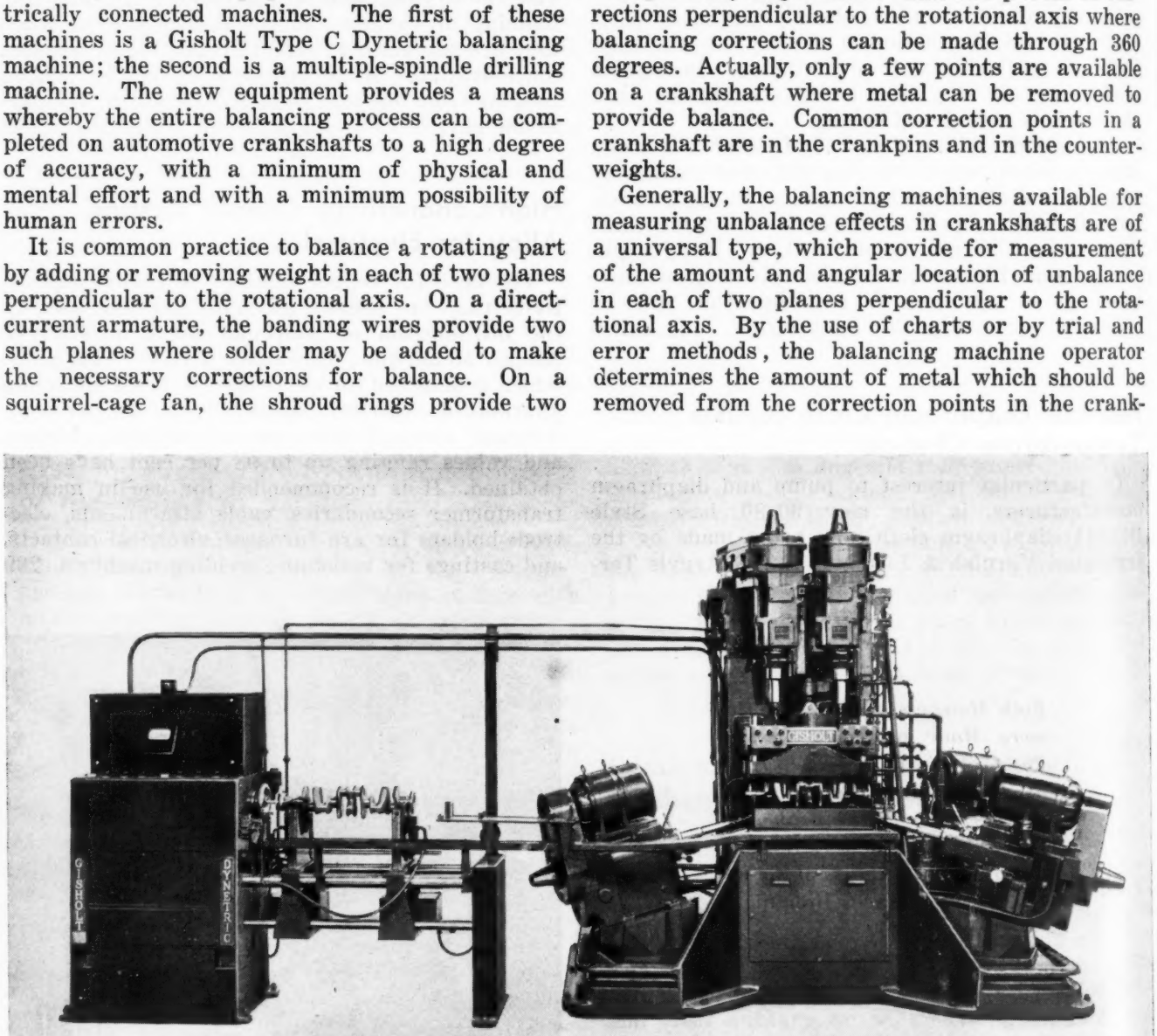


Fig. 1. Gisholt Semi-automatic Equipment for Measuring and Correcting Unbalance in Automotive Crankshafts

shaft. The balancing machine operator marks on the crankshaft the amount and position of the drilling corrections. The marked crankshaft is then passed on to a drilling machine operator for removing the required amount of metal by drilling.

The Gisholt Type C Dynetric balancing machine is arranged to indicate directly the amount of metal which should be removed from specific points in a crankshaft in order to produce balance. The points for unbalance correction are determined only by the limitations of the crankshaft. For example, in a four-bearing, six-throw crankshaft, corrections for balance may be made by drilling into Nos. 1, 2, 5, and 6 crankpins and into the kidney cheek between Nos. 1 and 2 crankpins, and between Nos. 5 and 6 crankpins. The balancing corrections in the kidney cheek are in the radial direction of Nos. 3 and 4 crankpins.

With such an arrangement of correction drilling, there are, on each end of the crankshaft, three points spaced 120 degrees apart where it is possible to drill for balance. To obtain combined static and dynamic balance of any crankshaft, it is actually only necessary to drill two of the three holes in each end of the crankshaft.

The balancing machine seen to the left in Fig. 1 is arranged to measure the exact amount of correction that should be applied at each of the six points mentioned to give both static and dynamic balance. These six balancing machine indications are electrically transmitted to the six-spindle drilling machine shown at the right. In this drilling machine, the spindles are arranged so that holes can be drilled at the required points of correction. The depth to which each hole is drilled is automatically set from the corresponding balancing machine measurement.

The first step in the balancing process is to load the crankshaft into the balancing machine from the production line. By movement of a lever, the crankshaft is hydraulically lowered into position on the vibratory supports of the balancing machine. The operator attaches the balancing machine driver to the crankshaft and presses the starting button. The operator is now ready to measure the amount of correction to be applied at each of the six points, which corrections are automatically recorded and transmitted to the automatically operated drilling machine.

When the measuring operation is completed, the driving coupling is removed from the crankshaft. The crankshaft is then raised hydraulically, so that the operator can easily slide the crankshaft onto a dolly. When the dolly is loaded, it is unlatched and moved on to the correction drilling machine. By the use of this dolly, the balancing machine operator is required to do much less lifting than is necessary in previous balancing processes.

When the dolly has arrived at the correction drilling machine, the crankshaft is in the proper angular position to be moved directly into the machine. The crankshaft can enter the drilling fixture in only one angular position, so that it is located properly for correction drilling.

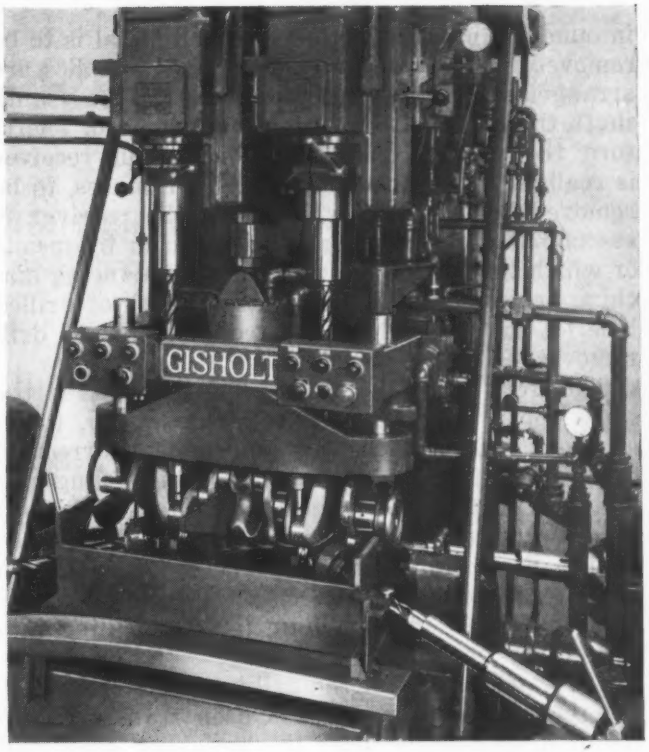


Fig. 2. Close-up View of Machine that Performs Correction Drilling Operations on Crankshafts

The correction drilling cycle in the machine shown in Fig. 2 is started by simultaneously pushing two starting buttons, one with each hand. The drilling cycle actually consists of these automatic operations: (1) Properly locating the crankshaft in an endwise position by hydraulic means; (2) firmly supporting and clamping the crankshaft in the fixture; (3) bringing up hydraulically operated wedges against the rough forged surfaces of the crankshaft to provide support against the drill thrust; (4) starting the drills traversing toward the crankshaft and simultaneously initiating the flow of coolant over the drills; (5) causing each of the drills to drop into feed when the drills are approximately 1/8 inch from the surface from which metal is to be removed; (6) initiating depth measurement of each drill separately, and automatically, as the drill comes in contact with the crankshaft; (7) traversing each drill backward separately when that drill has removed an amount of metal corresponding to the balancing machine measurement; and (8) unclamping the crankshaft and returning it to a position from which it can be easily returned to the production line.

In this production process, the balancing machine indications are transferred to the drilling machine by means of self-synchronous transmitters and self-synchronous receivers. Attached to each of six weighing dials on the balancing machine is a self-synchronous transmitter. Each transmitter is electrically connected to a receiver on a drill spindle.

The balancing machine weighing dials actually measure unbalance effects in terms of ounce-inches —the product of the weight of metal to be removed,

in ounces, times the radius at which metal is to be removed, in inches. Because the drill spindles are arranged to drill at specific points in the crankshaft, the radius of correction is established. Therefore, the motion of the self-synchronous receiver is really a measure of the weight, in ounces, to be removed by the drill with which the receiver is associated. The receiver carries a cam by means of which the ounce-inch units of the balancing machine are converted into inches of depth of drilled hole. A given depth of a fixed diameter of drill removes a known weight of metal.

The drill will repeatedly produce holes to the same depth, for the same receiver setting, to an accuracy of 0.003 inch; this represents a correction error of less than 0.05 ounce-inch. The drilling unit and depth control were made by the Leland-Gifford Co., Worcester, Mass. The correction drills used on the Plymouth crankshaft are 1 1/8 inches in diameter for drilling into Nos. 1, 2, 5, and 6 crankpins, and are 1 inch in diameter for drilling into the kidney cheeks.

Three seconds after the drilling cycle is started, the receiver information has been transferred to its drill spindle, so that the weighing dials and transmitters on the balancing machine can be reset without changing the settings of the correction drills. This makes it possible for a balancing machine operator to be determining the amount of correction in a crankshaft while the drill operator is correcting a shaft in which unbalance measurements have been previously determined. A green light on the balancing machine advises the operator when the drilling machine has picked up information concerning the previously measured crankshaft.

Some of the drills on the correction machine cannot be seen by the operator. For this reason, the operator cannot be expected to determine when a drill has become so dull as to require regrinding. On the control panel, there is provided a numbered red light for each of the drill spindles. When any drill becomes dull, the red light associated with that spindle will be turned on by means of a hydraulic pressure switch. This light will stay on until the drill has been changed and the pressure switch manually reset.

The over-all accuracy of the balancing process with this balancing equipment on an average automotive crankshaft is 0.2 ounce-inch. This tolerance is made up of (1) a tolerance of 0.05 ounce-inch due to the 0.003 inch tolerance in depth control; (2) a tolerance of 0.05 ounce-inch due to a 0.003 inch variation in diameter of hole as produced by a sharp and a dull drill; and (3) a tolerance of 0.1 ounce-inch due to small errors in the balancing machine, errors between the self-synchronous transmitter and self-synchronous receiver, and the human errors in setting the weighing dials to cause the meter to read zero.

Production is largely determined by the time for drilling the deepest correction hole. Where 1 1/8-inch diameter correction drills are used, and where one of these drills may be required to drill a hole 1 7/8 inches deep, the cycle time on the drilling machine, including loading and unloading, is eighty seconds. Such a correction in the crankpin of an average automotive crankshaft represents a compensation for 18 ounce-inches of unbalance, which is an exceptionally large correction. The average cycle time for the drilling machine, including loading and unloading, is usually about sixty seconds.

The time required to obtain balancing machine indications is twenty-five seconds. Including loading and unloading, the cycle time of the balancer is about forty-five seconds. It is, therefore, evident that the process time on the average crankshaft is limited by the drilling cycle.

Change in Priorities for Purchasers of Surplus Machines

RECENT legislation has changed the priorities governing the sale of surplus machine tools from those given in the article "How to Buy Surplus Machine Tools" published in April MACHINERY, page 170. The new priorities are as follows:

1. Veterans, buying for their own use, not for resale, machinery set aside for them. (At present, there are no machine tools "set aside" for veterans.)
2. Federal Government departments, buying for their own use, not for disposition or transfer to others.
3. Veterans, buying for their own use, items that have not been set aside for them.
4. Reconstruction Finance Corporation, for resale to small business.
5. States, their subdivisions, and instrumentalities.
6. Non-profit institutions in the fields of health and education, which have been qualified.

All other classes of buyers, large or small, are to be handled "first come, first served."

The priorities here listed may be superseded by (1) a directive of the Civilian Production Administration; (2) Federal Public Housing Authority; and (3) the armed forces.

These priorities are imposed by the law, but in actual practice they are not as restrictive as they may seem. Federal departments, practically without exception, have retained what they need before declaring the remainder surplus. Local governments need comparatively few machines. When all of the government surplus reaches the market, there will be enough machine tools for everybody's requirements.

War Assets Corporation practice, today, therefore, is to do its best to help a manufacturer to get any kind of surplus machine tool he wants at the earliest possible moment.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

LeBlond Rapid-Production Lathe

The R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio, has recently redesigned and is now producing a 13-inch motor-head type rapid-production lathe, which is especially adapted for light cutting at extremely high speeds. The outstanding feature of the new lathe is the electric driving motor design, which has the stator and rotor built integral with the lathe headstock. Instead of the usual gears and belts, the headstock contains a stator bolted to the casting and a rotor which is pressed on the spindle.

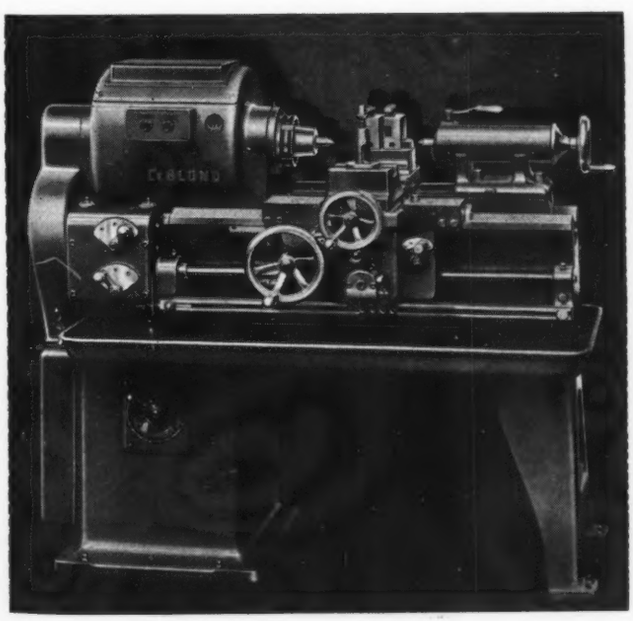
This motor head has an operating rating of 5 H.P. at top speed, and is said to run quietly and without vibration at speeds as high as 3600 R.P.M. A simple electric start-stop box replaces the usual control levers and handles. Light pressure on the starting button serves to set the spindle rotating at any preselected speed. Simply touching the stop-button brings the spindle to a smooth quick stop within a matter of seconds through application of the electrical braking system. All controls are within easy reach of the operator, including the new "finger-touch" speed-change handle.

Various attachments, such as those used on the standard 13-, 17-, and 20-inch LeBlond rapid production lathes, are also available for the new motor-head machine. The range and scope of this lathe can be further increased by the use of special tooling developed by the company's engineering department. 71

Hardinge Precision Second-Operation Machine Designed for High-Speed Production

A new Model DSM59 turret-equipped machine designed for the high-speed production of a wide variety of small parts that require second-operation machining to extremely close tolerances and finish specifications has just been announced by Hardinge Brothers, Inc., Elmira, N. Y. All the important features incorporated in previous models of the Hardinge line of second-operation machines have been retained in this new model, which also embodies many new developments. The steel bed ways, of improved dovetail design, for example, are ground to master gages after hardening to assure sustained accuracy and precision interchangeability of attachments. The dovetail ways form a solid steel bed top, and are so designed that they protect the accurate angular surfaces from falling chips and foreign matter.

The bed has a three-point mounting on the welded steel pedestal base, which insures maintenance of the original bed accuracy even when the machine is placed on an uneven floor. The fully enclosed headstock has a preloaded ball-bearing spindle ground to take standard 1-inch capacity 5C Hardinge collets and 6-inch capacity step chucks. The spindle is supplied with either the Hardinge standard taper nose or standard threaded nose for direct application of step chuck closers, jaw chucks, and faceplates.



LeBlond Motor-head Rapid-production Lathe

Hardinge Precision Second-operation Machine

To obtain additional information on equipment described on this page, see lower part of page 236.

The collet closer, for instantly closing and opening collets or step chucks, is equipped with ball bearings to facilitate operation when the spindle is at rest or when running at any of the operating speeds up to 4000 R.P.M. The rugged double-tool cross-slide is designed with a full bearing on the base to assure rigidity and sustained accuracy when taking heavy forming cuts. The cross-slide toolpost takes standard 3/8-inch square tool bits. When desired, the regular toolposts can be replaced by No. 00 circular form tools and holders. A straight or taper turning slide can also be applied for turning or boring.

The turret-head is mounted on preloaded ball bearings to eliminate play between it and the turret-slide. The turret-head index-pin is mounted on preloaded roller bearings to eliminate radial play between the turret-head and slide. It is claimed that this combination of preloaded ball-bearing turret-head mounting and preloaded roller-bearing index-pin is an important factor in obtaining more accurate indexing and greater rigidity of the turret tool mounting. The turret-head is bored to take standard 5/8-inch shank tools. The height and length of the turret operating lever can be adjusted to suit the operator.

The coolant system, furnished as standard equipment, has a self-draining oil-pan for rapid return of the coolant to the sump, which is an integral part of the oil-pan. The welded steel pedestal base fully encloses the driving unit and tool storage compartment. The electrical equipment is a built-in part of the machine, and includes magnetic control with time-lag thermal overload relays and low-voltage protection. A transformer provides 110-volt current for the push-button control current.....72

Michigan Sine-Line Lead Comparator for Helical Gears

Two new sine-line lead comparators for helical gears, known as Models 1200 and 1200A, have been brought out by the Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich. These comparators are claimed to be virtually fool-proof, and are designed for use on the production floor beside gear-cutting and gear-shaving machines. They can be used in setting up gear-cutting and finishing machines, in checking gears after processing, and in determining the amount of lead compensation required to counteract the helix "unwinding" effect on the gears produced by heat-treating or other operations.

The machines are applicable to both external and internal gears, as well as worms. To change a machine over for checking gears of a different lead, it is only necessary to replace the master lead member with one having the required lead. Different gears of the same lead can be checked by the use of interchangeable mandrels. One type of multiple lead master has four threads, which provides for checking at four points on the periphery of the gear.

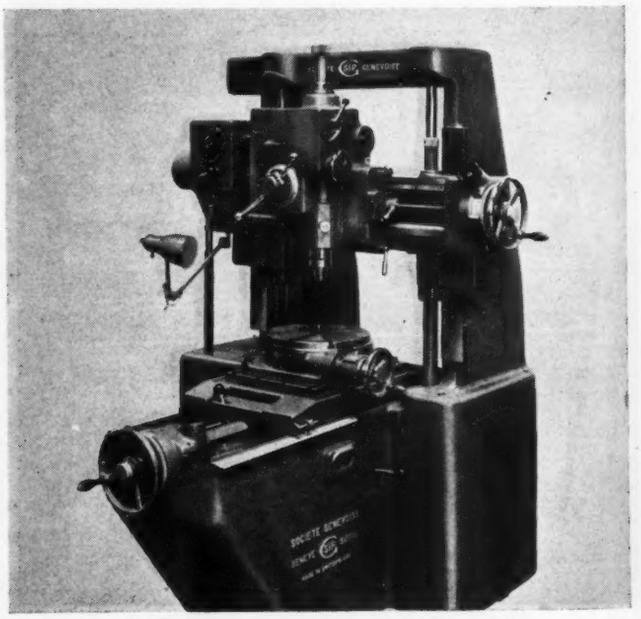
The Model 1200 lead comparator will check helix angles up to 45 degrees at several points around the periphery of either internal or external helical gears. The 1200A comparator can be used for checking gears with larger helix angles and for checking the leads on worms. Both types of comparators will handle work requiring a maximum swing of 10 inches. The master multiple-thread lead-screws, followers, indicators, and actuating mechanisms are all enclosed.

With the gear or worm to be checked mounted on the mandrel and the indicator assembly adjusted to the normal position relative to the helix angle of the gear, the contact point is brought to bear against the tooth surface. To check the lead, the handwheel is rotated so that the tooth surface moves past the indicator contact point. Any deviations are shown on the indicator, which is graduated in increments of 0.0001 inch. Accuracy of curve-shaving, as well as lead, can be checked in this manner. 73

New Sip High-Precision Jig Borer

The Cosa Corporation, 5000-4 Chrysler Bldg., New York 17, N. Y., representative in the United States for Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, has just announced the addition of

Sine-line Lead Comparator for Helical Gears



New Sip High-precision Jig Borer

To obtain additional information on equipment described on this page, see lower part of page 236.

the Type 3K jig borer to the Sip line of high-precision jig borers. This new jig borer is of the planer type. It is equipped with built-in measuring screws and micrometer heads. Precision locating of holes is accomplished by direct readings made to 0.00005 inch on the verniers of large divided drums. Automatic correctors compensate for any source of error in the measuring device, and there is a guaranteed accuracy for settings of the work-table and spindle saddle of 0.0002 inch.

The table of this machine has a working surface of 20 1/2 by 15 inches. The work-table has a longitudinal travel of 18 inches, and the spindle saddle has a transverse travel of 14 inches. The maximum distance from the table top to the spindle nose is 20 1/2 inches, and the minimum distance 4 3/4 inches. The free distance between uprights is 23 1/2 inches, and the vertical travel of the cross-rail 15 3/4 inches.

The eight spindle speeds of this machine range from 75 to 2000 R.P.M., and six automatic feeds in either direction assure rapid operation on a wide variety of work. Special construction and highly specialized design of all parts of the machine enable it to withstand heavy strains without loss of accuracy. The cross-roll is traversed vertically by a motor which drives two elevating screws of high precision, which guarantee the accuracy of the horizontal position of this member. The elevating screws extend down into the bed, and are automatically lubricated by oil baths.

The jig borer is supplied with a special guiding arm which facilitates the machining of very small holes. A depth measuring device can be mounted on the spindle head which permits accurate limiting of the boring head movement. This depth measuring device can be used either as a sliding caliper or as a comparator. The 3K machine, besides being used as a jig borer for precision work of extreme accuracy, can also be employed as a versatile measuring instrument. 74

Viking Hand-Tapper

The Viking Tool & Machine Corporation, 8 Main St., Belleville 9, N. J., has just placed on the market a new hand-tapper which has an adjustable arm of unique construction. This arm can be quickly and easily raised or lowered and swung to the right or left to accommodate work of any height up to 18 inches. Accurate alignment of the work and tap in all positions of the arm prevents tap breakage and permits the use of high-speed ground thread taps.

The need for employing a vise with this tapper is eliminated by the provision of two sliding parallel bars which hold the work firmly in place. Quick-changing adapters permit the taps to be changed in five seconds. Adapters are available in eight standard sizes ranging from 1/4 to 7/8 inch. 75

Hand-tapping Fixture Made by the Viking Tool & Machine Corporation

Hydropress Die-Casting Machine

Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y., has just completed a line of six "Hydrocast" cold-chamber die-casting machines by the addition of the Model 3 machine shown in Fig. 1. The new machine is similar in design to the other recently announced models of this line, which now covers an injection pressure range of 10 to 190 tons and a casting volume range of 3 to 300 cubic inches.

The self-contained, semi-automatic machines of this line are hydraulically operated and electrically controlled. They are built to suit in-

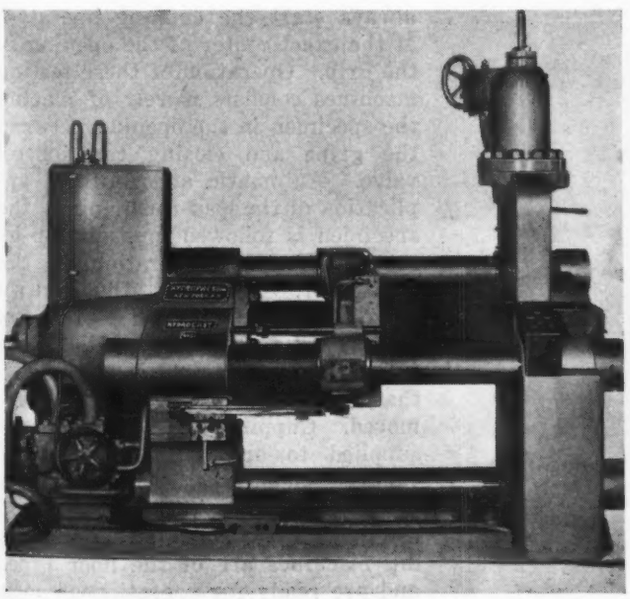


Fig. 1. "Hydrocast" Cold-chamber Die-casting Machine

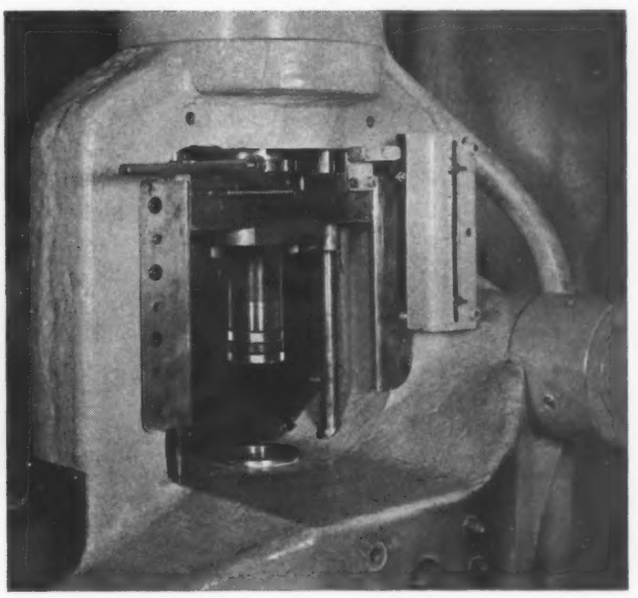


Fig. 2. Injection Chamber of Die-casting Machine

To obtain additional information on equipment described on this page, see lower part of page 236.

dividual requirements for either "water hydraulic" or "oil hydraulic" operation in the die-casting of copper, aluminum, magnesium, and zinc alloys. They have three tie-rods, are of horizontal design with vertical injection chambers and pouring stations (Fig. 2) separated from the die so that metal cannot be injected unless the die is closed.

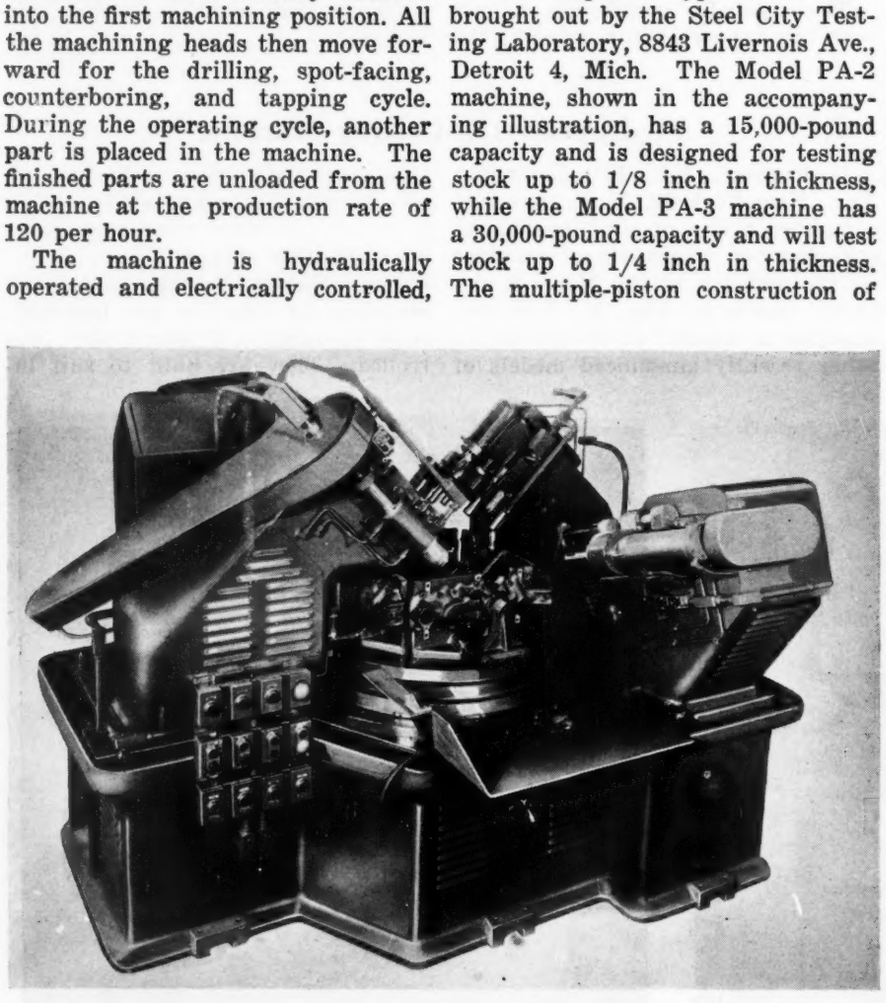
A double-action valve provides for a slow injection speed followed by a booster action which increases the speed as injection progresses. This feature insures filling the die or mold with metal at the proper velocities and applying the high final pressures required for best results. The casting is ejected automatically on opening the die. 76

"Hy-Mac" Special Machine for Drilling, Spot-Facing, Counterboring, and Tapping

A special-purpose "Hy-Mac" four-stage machine designed for drilling, spot-facing, counterboring, and tapping the vacuum holes in intake manifolds has been built by Hydraulic Machinery, Inc., 12825 Ford Road, Dearborn, Mich. The operating cycle of this machine is entirely automatic, except for loading and unloading.

After the work is manually loaded and clamped in position, the safety door is closed. This action closes an electric circuit, which causes the work to be automatically indexed into the first machining position. All the machining heads then move forward for the drilling, spot-facing, counterboring, and tapping cycle. During the operating cycle, another part is placed in the machine. The finished parts are unloaded from the machine at the production rate of 120 per hour.

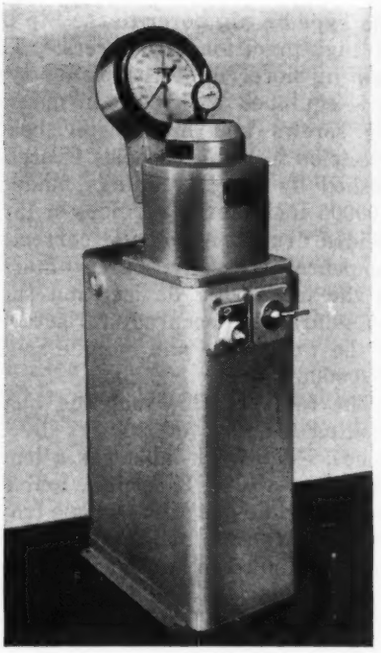
The machine is hydraulically operated and electrically controlled, safety features being provided to prevent indexing until the work is properly clamped in position. Hydraulic power and control valves are mounted in the base, where they are easily accessible for servicing through conveniently positioned doors. 77



Special "Hy-Mac" Machine Equipped for Drilling, Spot-facing, Counterboring, and Tapping Intake Manifolds

Sheet-Metal Ductility Testing Machine

Two new ductility testing machines of the cup-test type have been brought out by the Steel City Testing Laboratory, 8843 Livernois Ave., Detroit 4, Mich. The Model PA-2 machine, shown in the accompanying illustration, has a 15,000-pound capacity and is designed for testing stock up to 1/8 inch in thickness, while the Model PA-3 machine has a 30,000-pound capacity and will test stock up to 1/4 inch in thickness. The multiple-piston construction of these new machines is designed to automatically hold the specimen to be tested between the grips under a loading pressure that is properly proportioned to the pressure applied in forming the cup. This automatic specimen clamping feature is claimed to be an important improvement over the manual clamping methods employed on previous models. The illustration shows the convenient positioning of the easily read gages.



Ductility Testing Machine Placed on the Market by the Steel City Testing Laboratory

Accurate alignment or concentricity of the upper specimen grip held in the head and the grip mounted in the piston causes the penetrator to always start the cupping operation at the exact center of the opening in the grip. Operation of these testing machines consists merely of placing the specimen in the opening between the grips and closing the control valve. Automatic and uniform application of the load for gripping the specimen is followed immediately by the cup forming operation of the penetrator. Reversing the control valve then releases the pressure, causing all functioning parts to return to their original positions, so that the specimen can be easily removed. Cupping tools and dies are supplied to accommodate stock of various thicknesses. A set of tools is provided to facilitate removal of the grips and penetrator. The testing machines are of the floor type, and are ready for operation as soon as connected to the plant current supply. 78

To obtain additional information on equipment described on this page, see lower part of page 236.

G-E Electronic Heater for Plastic Preforms

G-E Dielectric Heater for Plastic Preforms

A new electronic heater designed for fast dielectric heating of plastic preforms is a development of the Industrial Heating Division of the General Electric Co., Schenectady 5, N. Y. This heater is adapted for operation at 40 megacycles, using a water-cooled oscillator tube. The tube functions at a high frequency and has a generous short-time "overload capacity," which makes possible the use of an average full-power 5-K.W. output during the entire heating cycle. This arrangement serves to speed up the preheating operation without the use of complex control equipment.

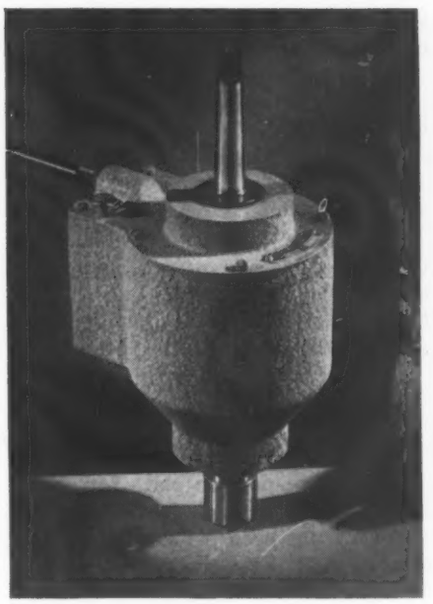
After the plastic preforms are placed on the electrode of the oven-like preheater, the cover is closed and the preheat cycle is started by means of a push-button. The rest of the operation is entirely automatic, the oven cover opening automatically at the end of the preset heating cycle to permit transferring the preforms to the adjacent molding press. 79

Haskins Drill Press Tapping Head

A tapping head designed to fit any standard drilling machine has been developed by the R. G. Haskins Co., 617 S. California Ave., Chicago 12, Ill. This new tapping head is available in three sizes: No. 1, with either No. 1 or No. 2 Morse taper shank; No. 2, with No. 2 or No. 3 Morse taper shank; and No. 3, a heavy-duty head provided with a quill type adapter only.

The rated capacities of these tapping heads in mild steel or brass range up to 1/4 inch for the No. 1 head; No. 6 to 3/8 inch N. F. for the No. 2 head; and No. 8 to 1/2 inch N. F. for the No. 3 head. If desired, the tapping heads can be furnished with a special combination tapping and external threading spindle. Standard Acorn dies can be used without extra adapters or holders. In order to insure maximum efficiency, individual ground collets are available for each size tap. Where a more permanent installation is desired, any of these tapping heads can be furnished with an adapter to suit the measurements of the drill press quill and spindle.

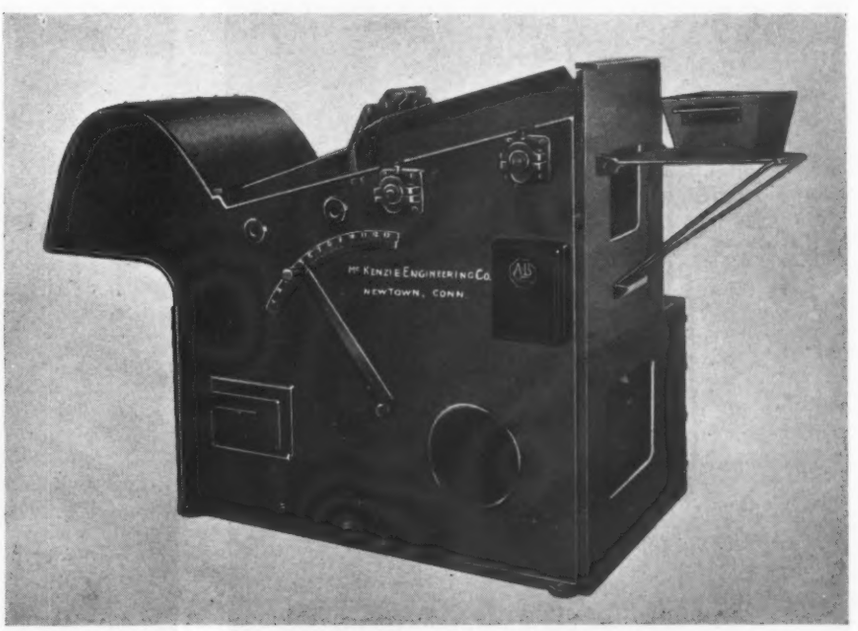
When the tap comes in contact with the work, the clutch is automatically seated with a cushioning effect in the driving shell. This sensitive cushioning action permits the clutch to slip should the tap meet with an obstruction, and thus prevent tap breakage. When the bottom of the stroke is reached and the tapping head is retracted, the clutch is immediately engaged by the reverse driving shell, which changes the direction of tap rotation and permits the operator to withdraw the tap from the hole at twice the tapping speed. 80



Drill Press Tapping Head Built by R. G. Haskins Co.

McKenzie Chip Separator for Screw Machine Products

A Model D chip separator for screw machine products which has many improvements over previous models has just been announced by the McKenzie Engineering Co., Newtown, Conn. This machine separates finished parts from chips of steel, brass, and aluminum after the oil has been extracted. It will separate parts from 1/8 inch in diameter by 1/4 inch long up to 1 1/2 inches in diameter by 5 inches long, and will



Chip Separator for Screw Machine Products Built by McKenzie Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 236.

also separate parts from long steel chips.

When this machine is in use, it is only necessary for the operator to take the pan from the oil extractor, empty it into the self-feeder and regulate the air blast to suit the size of the parts to be separated. The machine feeds the material into the vibrator, spreads it out, and shakes the parts loose, blowing the chips into a box, bin, or conveyor and letting the finished pieces fall into the work pan. The machine has a capacity for handling work of this kind at the rate of a bushel a minute.

The illustration shows a Model D machine of the cabinet type with heavy steel self-feeder and vibrator, blast gate in blower, 3-H.P. motor coupled directly to the blower, and 3/4-H.P. motor with chain drive for the self-feeder and vibrator. The dimensions of the complete machine are 5 feet by 3 feet 8 inches by 2 feet 6 inches. 81

Ex-Cell-O Taper Inspection Plate

A taper inspection plate for checking tapers and angles with sine-bar accuracy has been placed on the market by the Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 6, Mich. The new inspection fixture consists of a pivoted sine bar carrying adjustable centers and equipped with a handwheel-operated mechanism for lifting and lowering one end. Precision gage-blocks or standard taper height blocks are used to establish the proper checking angle. The elevating screw exerts no pressure against the checking block, the gaging pressure being only that exerted by the constant weight of the sine bar.

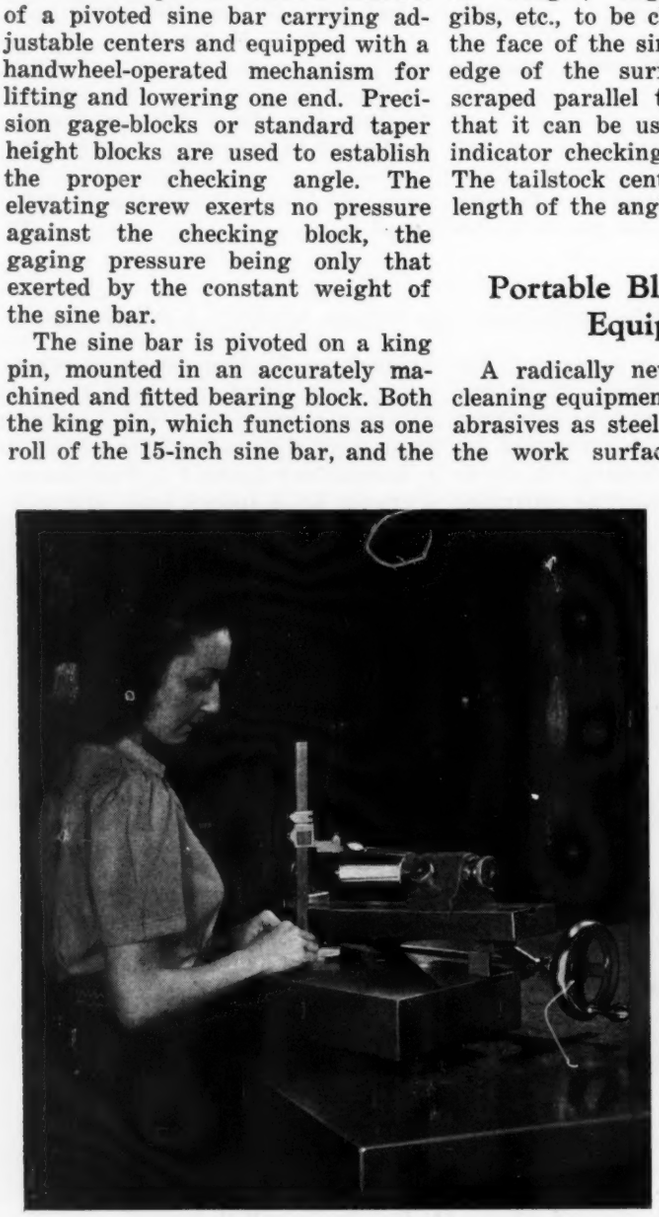
The sine bar is pivoted on a king pin, mounted in an accurately machined and fitted bearing block. Both the king pin, which functions as one roll of the 15-inch sine bar, and the other roll are hardened and lapped to precise dimensions. The fixed center carries a hardened block that is at an angle of 90 degrees with the line of the centers, permitting angles on wedges, angle-blocks, tapered gibs, etc., to be checked directly on the face of the sine bar. The front edge of the surface-plate base is scraped parallel to the centers, so that it can be used as a guide for indicator checking of various types. The tailstock center moves the full length of the angle-plate. 82

Portable Blast Cleaning Equipment

A radically new design of blast cleaning equipment that applies such abrasives as steel grit or Aloxite to the work surface, separates and reclaims the abrasive so used, and collects and stores the resulting dust is being manufactured by the Vacu-Blast Co., 1054 Broadway, Burlingame, Calif. The new equipment, called the "Vacu-Blaster," consists of five units—a specially designed blasting gun, an abrasive reclaimer, a dust collector, an abrasive storage tank, and a vacuum pump unit. All units, except the gun, are mounted on casters, so that they can be readily moved about the plant or around large work.

The "Vacu-Blaster" gun is light enough to be operated with one hand, and it is equipped with a push-button that controls the entire cycle of operations. The gun consists of a blasting nozzle enclosed by a cone which, in turn, is surrounded by a vacuum pick-up cone. The gun is further enclosed at the point of surface contact by a brush in a flexible retainer. The brush is held in contact with the surface to be cleaned, and the air stream to the vacuum return line effects a positive pick-up of all dust, dirt, abrasive, or other foreign matter.

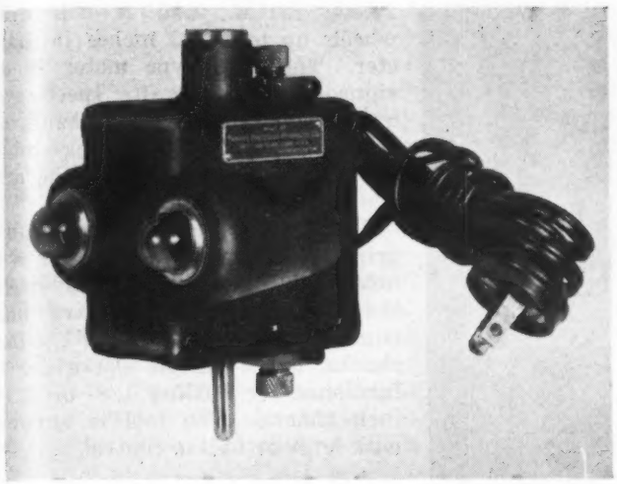
The equipment is designed to clean steel, stone, brick, cement, concrete, or other surfaces without scattering any of the refuse or abrasive or filling the air with dust particles. Blast cleaning is carried on without hazard to the operator or adjacent equipment and without interrupting other operations that are being performed near by. 83



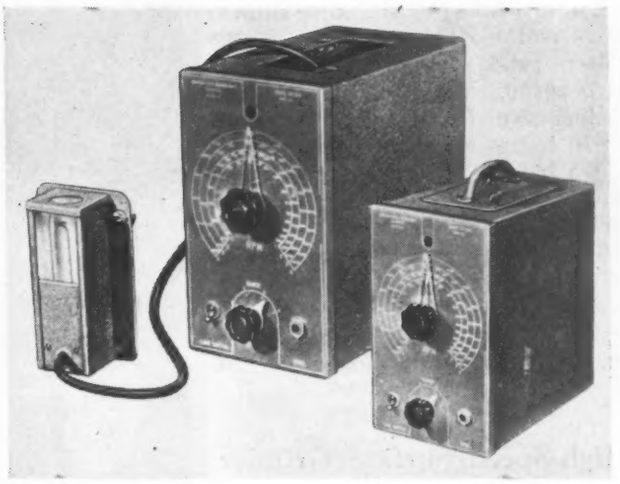
Ex-Cell-O Taper Inspection Plate

Portable "Vacu-Blaster" Cleaning Equipment

To obtain additional information on equipment described on this page, see lower part of page 236.



Electronic Self-contained Gage-head Brought out by the Yankee Precision Products Co.



Portable Stroboscope Brought out by Communication Measurements Laboratory

Lightronic Gage-Head

The Yankee Precision Products Co., 50 Bartholomew Ave., Hartford, Conn., has brought out a new electronic self-contained gage-head for direct connection to a 110-volt circuit without the use of transformers, tubes, or rectifiers. The gage, complete with plus and minus indicating lights, will operate within a gage setting of 0.00001 inch. The head can be attached to the purchaser's support or it can be arranged to suit any specific application. If close nesting of the heads is necessary, the light brackets can be removed and placed in a panel. This arrangement reduces the head width to 7/8 inch.

The electrical gas contact arrangement incorporated in this gage is said to eliminate any contact sparking tendency. The complete unit is about 2 3/4 inches square, and of simple, sturdy construction. 84

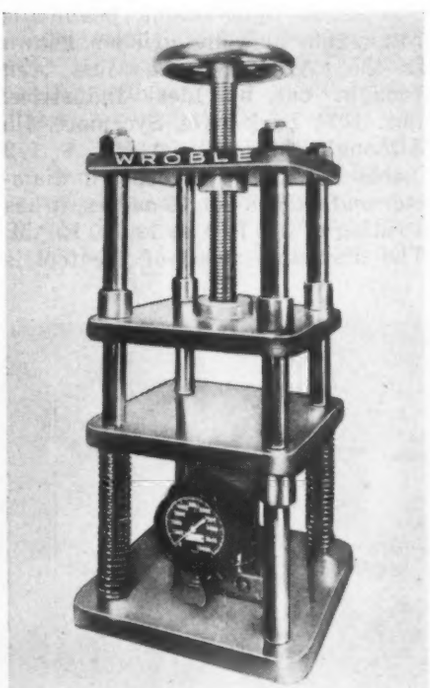
Portable Stroboscope

A recently developed Model 1210 stroboscope, brought out by the Communication Measurements Laboratory, 120 Greenwich St., New York 6, N. Y., employs a novel circuit arrangement using a self-blocking oscillator. Rotary or vibratory motion can be "stopped" with this equipment when the moving object is examined with the stroboscopic light source. The instrument covers a speed range of from 600 to 48,000 R.P.M. (10 to 800 cycles per second) in four ranges. A synchronized reed is provided for accurate calibration against the line frequency. All four scales can be easily and quickly calibrated within plus or minus 3 per cent. In addition to permitting the slow motion study of rotating, reciprocating, or vibratory mechanisms, the stroboscope is useful for studying mechanical stresses and strains under dynamic conditions, and for determining their speed or rate of movement.

The light source is contained in a probe attached to a 4-foot flexible cable. This unusual feature is especially useful when employing the stroboscopic light in restricted out-of-the-way places. The instrument weighs only 19 1/2 pounds, and is enclosed in a cabinet 10 1/2 by 5 3/8 by 10 1/2 inches. 85

Wroble Hydraulic Presses

A rugged four-rod universal hydraulic press, built in 25-, 35-, and 50-ton capacities for laboratory, machine-shop, and general-purpose use, is being placed on the market by the Wroble Engineering Co., Hydraulic Press Division, 1067 Davis Terrace, Schenectady 3, N. Y. These presses are especially adapted for plastic molding, powder metallurgy, die try-out, die-sinking, and straightening work, and for compression testing. They are provided with an adjustable top platen carried by a ball-bearing swivel designed for rapid press work.



Universal Hydraulic Press Brought out by Wroble Engineering Co.

The presses are operated by a hand-pump. Spring push-back members insure quick return of the ram platen. A gage calibrated in pounds per square inch indicates the total ram load in tons. The presses can be furnished with holes drilled in the platen for mounting die sets and molds, and with four bolt-holes in the base for mounting purposes.

The 35- and 50-ton presses are equipped with double pumps of the high-speed, high-pressure type for rapid pressing with a minimum expenditure of time and effort. The 25-ton press has an adjustable top platen 14 by 14 inches. The ram platen is also 14 by 14 inches, and has a movement of 6.5 inches. The opening between platens on this size press ranges from 0 to 18 inches. The total weight of this machine is 500 pounds.

The 35-ton press is made with top

To obtain additional information on equipment described on this page, see lower part of page 236.

and ram platens of the same dimensions and movement ranges as the 25-ton press, and is also available with an adjustable top platen 16 by 16 inches, and with a ram platen 16 by 16 inches which has a movement of 6.5 inches. The opening between the platens ranges from 0 to 14 inches. The weight is 685 pounds.

The 50-ton press also has platens 16 by 16 inches. The opening between platens on this press is adjustable from 0 to 12 inches. This machine weighs 750 pounds. 86

High-Speed Surface Grinder Attachment

A new high-speed surface grinder attachment, known as the Stafford "Blitzrev," is being manufactured by the D. & S. Model Co., 3114-30 E. Third St., Dayton 3, Ohio. This attachment can be installed in five minutes on most standard makes of surface grinders. It permits the operator to use small grinding wheels ranging from 1/8 inch mounted quill types to 3-inch diameter abrasive wheels.

Speeds of 10,000 and 15,000 R.P.M. are obtainable with the standard two-step pulley of this attachment. A special pulley is available for higher speeds. An air flushing arrangement is employed, whereby a fan mounted on the revolving shaft inside the housing sets up an outward flow of air which prevents the entrance of dirt and dust. Circular surfaces on gages and dies can be readily ground with this attachment, which is designed to handle a wide range of difficult grinding jobs. A driving pulley is mounted on the surface grinder spindle to replace the standard 7-inch wheel. This pulley, by means of a belt, drives the high-speed spindle of the attachment.

Stafford "Blitzrev" Surface Grinder Attachment

A dovetail slide allows a forward and backward movement of the attachment which permits grinding over the full surface of the magnetic chuck with a 2-inch diameter wheel. The attachment can be swung through an angle of 360 degrees to increase the grinding range. Six standard quills and their accompanying wrenches are furnished complete in a wooden chest.....87

"Air-Horse" Rotary File and Die Grinder

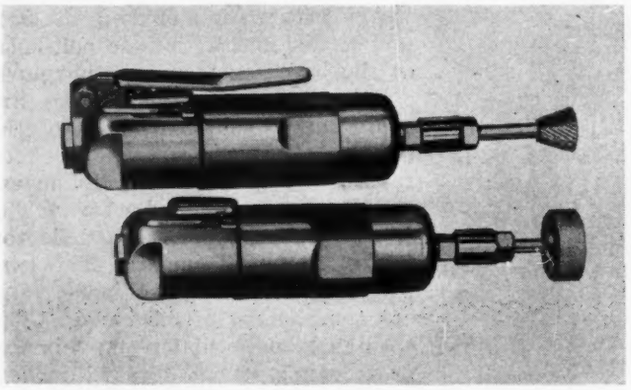
A small, light-weight, pneumatic rotary file and die grinder known as the "Air-Horse" has just been brought out by Ideal Industries, Inc., 1011 Park Ave., Sycamore, Ill. Although this tool is only 6 1/2 inches long by 1 1/2 inches in diameter and weighs but 16 ounces, it has a rating of 1/4 H.P. at 19,000 R.P.M. The maximum speed of the tool is 25,000 R.P.M., and it will drive wheels up to 1 1/2 inches in diameter. The vane type motor is designed to maintain its speed even under heavy loads. The exhaust air from the ports at the chuck end of the grinder serves to blow the dust and chips away from the work.

The flexible sleeve of the double-grip type collet chuck is designed to hold both over-size and under-size shanks securely. The standard chuck is made to hold tools having 1/4-inch shanks, but a flexible sleeve can be furnished for holding 1/8- or 3/16-inch shanks. The tool is supplied with lever or button control. 88

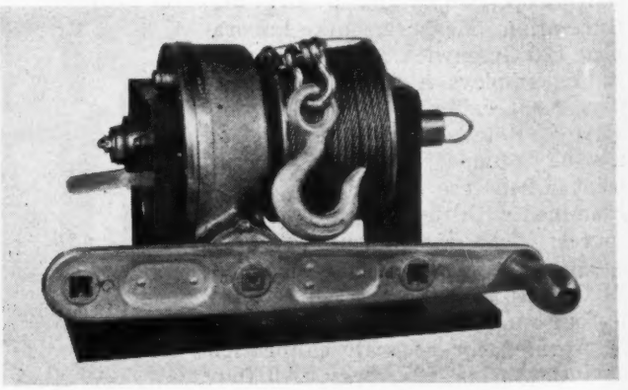
Taylor Utility Hoists

A hoist weighing less than 40 pounds, with a gear ratio of 24 to 1, which will lift 2000 pounds has just been placed on the market by the Taylor Machine Co., 1917 E. 61st St., Cleveland 3, Ohio. These hoists were originally designed for the U. S. Army Air Forces, and are known as the C-3A bomb hoists. The comparatively light weight and small size of these hoists make it possible to easily transport and install them at any point desired.

The hoist housing, cover, and cable drum are made of aluminum, and all the working parts are of steel except the worm-gear, which is made of bronze. The hoist is equipped with a preformed steel cable, 18 feet in length, having forged steel hooks. It is provided with a brake and ratchet. Ball bearings and cast-bronze graphited bearings are used throughout. The crank can be adjusted to three different lengths to suit the operator's convenience. A welded steel base, 5 inches wide by 12 inches long by 5/8 inch thick, facilitates attachment to a truck body or any other solid structure. 89



"Air-Horse" Rotary File and Die Grinder Brought out by Ideal Industries



Utility Hoist Placed on the Market by the Taylor Machine Co.

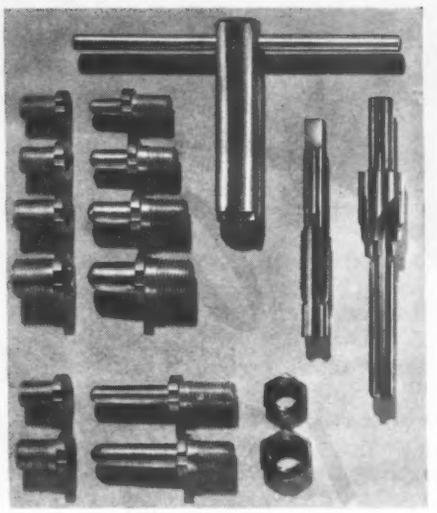
To obtain additional information on equipment described on this page, see lower part of page 236.

Non-Metallic Three-Way Valve

A flexible molded synthetic rubber tube encased within a Bakelite body comprises the complete operating member of the new Flex-Tube three-way valve brought out by the Grove Regulator Co., 65th and Hollis Sts., Oakland 8, Calif. This valve is designed for handling all types of fluids including gases, chemicals, and liquids, and is especially suited for hydraulic or pneumatic cylinder operation. Its unrestricted straight flow characteristic also makes it satisfactory for controlling viscous fluids.

The non-metallic construction of this valve permits the handling of highly corrosive or erosive liquids or gases. Manual operation by means of an over-center cam opens and closes the port at each half turn of the handwheel. A special self-locking feature assures positive and tight shutting off of the valve over extended periods of time. These valves are available in 1/8- and 1/4-inch pipe sizes, and are furnished for working pressures up to 250 pounds and maximum temperatures of 150 degrees. 90

Non-metallic Three-way Valve Made by Grove Regulator Co.



Kindt-Collins Metal Dowels for Patterns and Core-boxes

Vangtronic Bench Welder

A stored-energy type of bench welder has been developed by the Vangtronic Corporation, 87 Washburn St., Bridgeport 5, Conn., for spot-welding similar or dissimilar metals and alloys of various thicknesses. The current discharge through the weld is controlled electronically, which aids in producing uniform welds. Welding rates of 30 to 180 spots per minute are obtainable.

The welding transformer, mounted directly below the lower electrode, is of the air core type, and an iron armature is used to produce a follow-up forging pressure. Aluminum, aluminum alloys, tungsten, platinum, stainless steel, cupro-nickel, and nickel silver are some of the metals and alloys that can be welded with this unit. 91

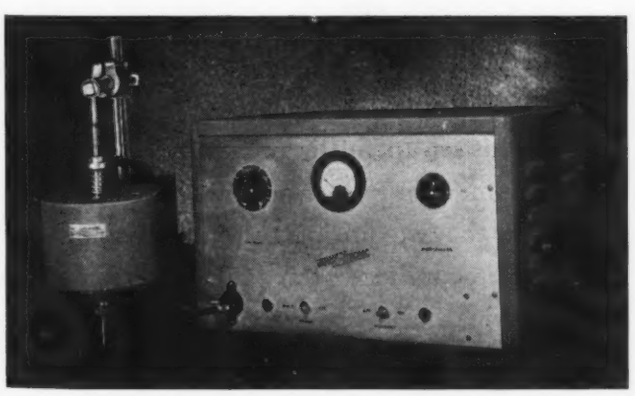
Metal Dowels for Patterns and Core-Boxes

An improved type of metal dowel for metal patterns and core-boxes has been announced by the Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11, Ohio. Advantages claimed for these new dowels, known as the "Master-Sure Lock," include easier, quicker, and more accurate insertion; dowel anchored securely by new type shoulder and taper fit of body; reduction in number of replacements and consequent loss of time; longer, more accurate draw with head of dowel entirely round in shape, there being no square edges that can be turned off by a wrench; new type wrench of hardened steel, which permits firm tightening of dowel with no stripping of dowel threads; machined from steel hardened and cadmium plated to prevent rust.

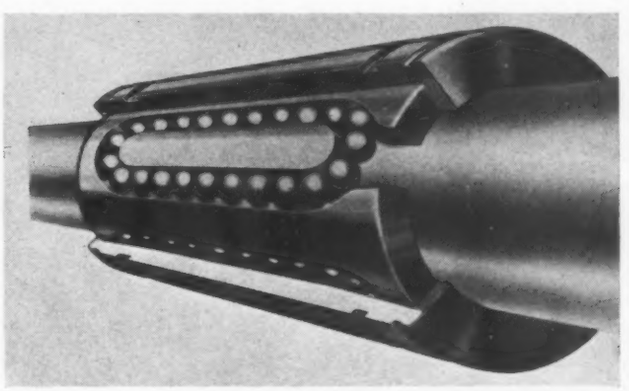
These dowels are available in Nos. 1, 2, 3, and 4 standard sizes, and in Nos. 2 and 3 special, with special extra long pin and body, which can be fitted with nuts for permanent installation. 92

Ball Bushing for Linear Motion

Thomson Industries, Inc., 29-05 Review Ave., Long Island City 1, N. Y., announce the standardization and production of their round-shaft type ball bushing for applications involving linear motion. These ball bushings are said to reduce the large length to diameter ratio usually re-



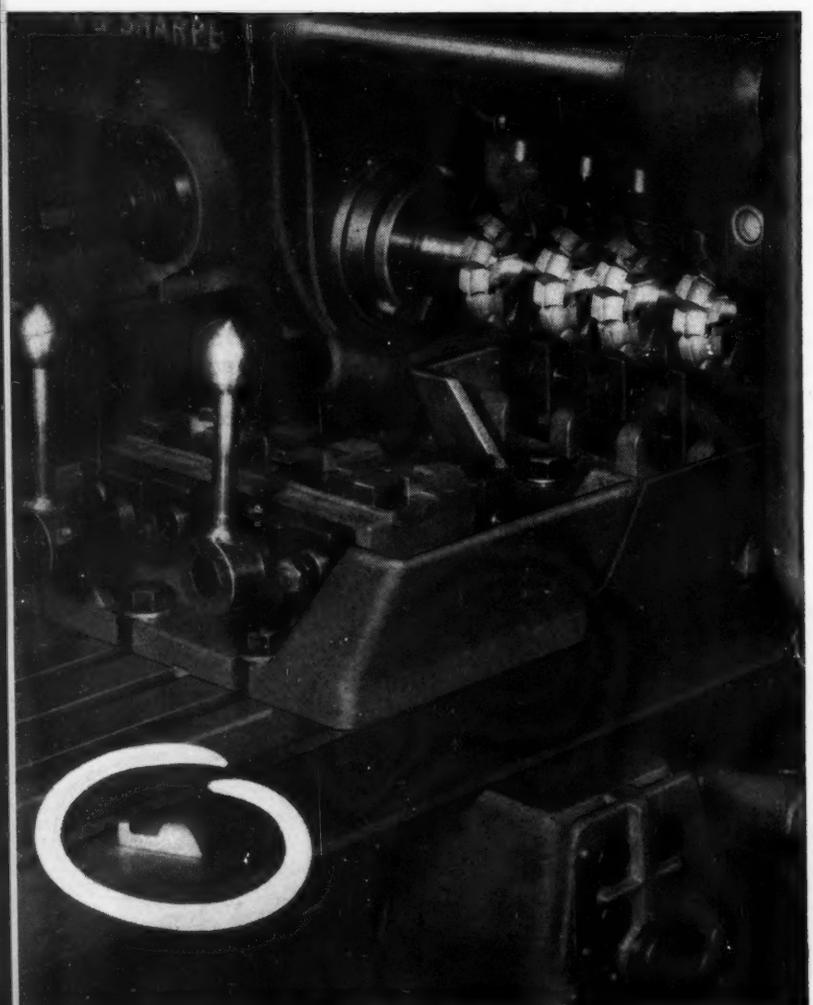
Bench Type Spot-welder Developed by Vangtronic Corporation



Thomson Ball Bushing for Linear Motion Applications

To obtain additional information on equipment described on this page, see lower part of page 236.

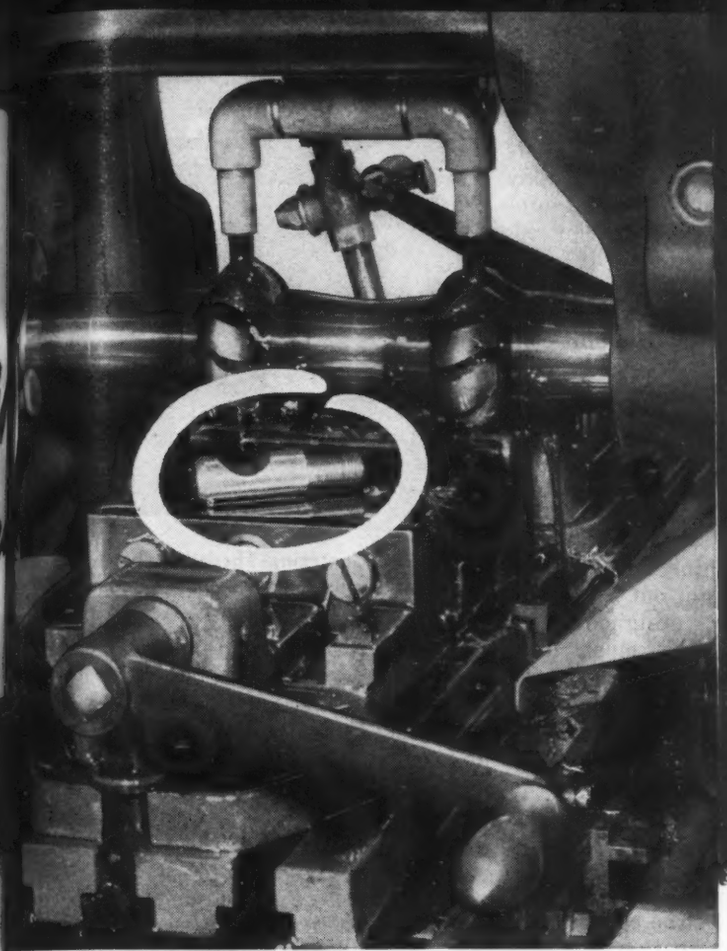
On these jobs No. 12 is cutting 90%...or better of every operating hour

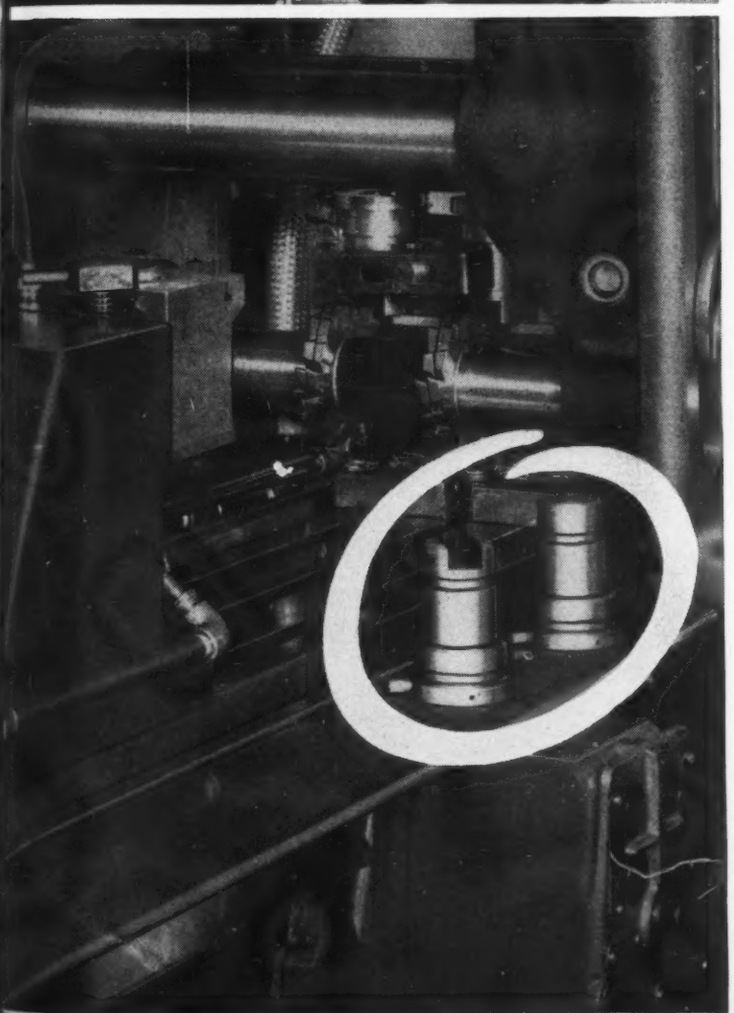


Continuous automatic milling increases cutting time and efficiency on these three set-ups with the Brown & Sharpe No. 12 Plain Milling Machine. Climb milling the work in one fixture and conventional milling it in the other requires only one set of cutters. The fixture at one end of the table is unloaded and reloaded while the pieces in the fixture at the opposite end are being milled. On hundreds of operations like these, Brown & Sharpe Milling Machines are enabling manufacturers to cut costs through *more productive machine time.*

The cutters are actually cutting 90% of the time in this set-up, milling the form on a steel Army tank door bolt. Four pieces are held in each of the two quick-clamping fixtures. Work is climb milled in the left hand fixture, conventional milled in the right. The cutting feed is 4 inches per minute.

BROWN &





Cutting time is 92% here, milling a groove in a steel cam lock stud. Two pieces are held and milled simultaneously in two standard flanged vises with formed jaws, one at each end of the table. The cutters climb mill the work in one fixture, conventional mill it in the other. The cutting feed is 2½ inches per minute.

Milling slots in steel fuse bodies, two at a time, the cutting time is 95% of the cycle. Since the amount of metal to be removed increases as the cut progresses, dual feed rates are used – 5⅛ inches per minute for the first part of the cut, 2-9/16 inches for the rest. By holding the pieces vertically the cut is made from underneath, leaving ample chip room and keeping the fixtures free of chips.

Write for detailed specifications

BROWN & SHARPE MFG. CO.

PROVIDENCE 1, R. I., U. S. A.

B·S

SHARPE

quired in plain linear bushings to prevent cocking and binding of the shaft. They possess the usual advantages of ball bearings, such as savings from the use of smaller drive motors, gears, linkages, etc.; operating economies due to reduced load; longer life; increased reliability; less servicing; higher operating speeds; and sustained precision. These ball bushings are available in shaft sizes from 1/4 to 1 inch in 1/8-inch steps, 1 inch to 3 inches in 1/4-inch steps, and 3 to 4 inches in 1/2-inch steps.

Standardization of ball bushings for square shafts is not yet complete, but this type can be furnished on an experimental basis for prototype equipment. 93

Ex-Cell-O High-Speed Grinding Spindle

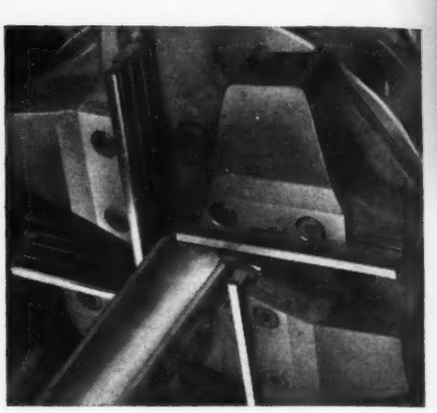
A new 25,000-R.P.M. high-speed grinding spindle with a built-in 1-H.P. high-cycle motor for grinding small holes has been developed by the Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 6, Mich., and is now being added to this company's line of precision grinding equipment. The balanced built-in motor spindle mounted on Ex-Cell-O precision ball bearings eliminates the need for a separate driving motor, motor base, belts, idlers and countershafts, and thus reduces vibration. Slippage and friction losses caused by power transmission are also eliminated.

This high-speed motorized spindle can be used to modernize old equipment or to simplify the operation of new machines. The unit as shown in the illustration or with slight alterations can be adapted to most small internal grinders. The statically and dynamically balanced motor is of the shaftless "cam" type. The stator is mounted directly in the spindle body and the rotor is mounted on the spindle shaft, no coupling being required. Grinding wheels or pencil type wheels are mounted either directly on the spindle shaft, interchangeable quills, or collet chucks. The unit consists of the spindle, frequency converter, and control panel. 94

Landis "Centering-Throat" Chasers

The Landis Machine Co., Waynesboro, Pa., has brought out a "centering-throat" chaser, designed especially for work that must have threads which are concentric with the outside diameter. This chaser is particularly adapted for threading valve stems and other work having long threads of coarse pitch. It can be used only when the outside diameter of the work is held to a uniform size, since this portion of the work serves as a bearing for the centering-throat section of the chaser. The chasers are flexible in that any difference in the outside diameter of the work can be corrected on the centering throat to maintain the proper pitch diameter. For example, if the outside diameter is 0.625 inch and the pitch diameter is 0.005 inch under the basic size, the centering-throat section of the chaser can be ground 0.0025 inch below the root of the thread to compensate for the difference.

In addition to maintaining concentricity between the thread and outside diameter of the work within extremely close limits, the centering-throat chaser eliminates the out-of-round condition that often exists when long work-pieces are threaded,



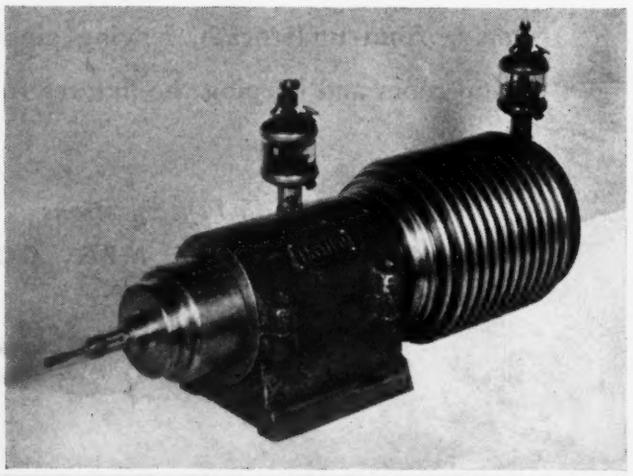
Landis "Centering-Throat" Chaser

requiring the work to extend for a considerable distance beyond the front of the carriage or chuck. The centering throat "takes a bearing" as soon as the chaser comes in contact with the work, and thus assures accurate, well formed threads from the start of the operation. 95

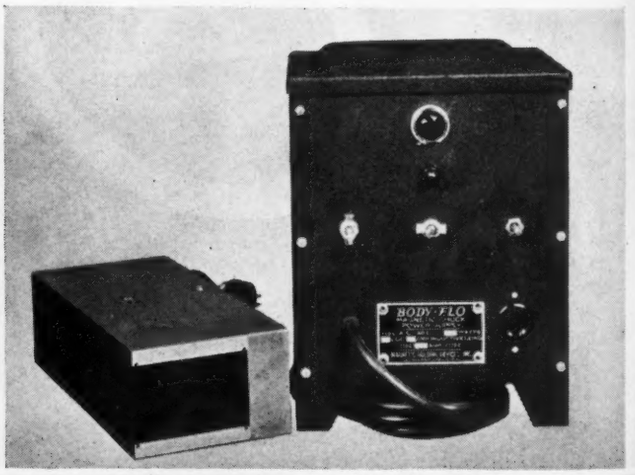
Heavy-Duty "Body Flo" Magnetic Chuck

A heavy-duty improved 12- by 4-by 3 1/2-inch "Body Flo" magnetic chuck and parallel made by Magnetic Holding Devices, Inc., 2034 E. 22nd St., Cleveland 15, Ohio, which was used extensively in tool-rooms on surface grinders and for production work during the war is now available with an improved power supply unit. This improved chuck and power supply is said to offer new possibilities for milling operations. It is especially recommended for "climb" or down milling with non-magnetic Carboloy or carbide-tipped cutters.

Magnetic power for the chuck is supplied by a unit which has two



Ex-Cell-O High-speed Grinding Spindle



"Body Flo" Magnetic Chuck and Parallel

To obtain additional information on equipment described on this page, see lower part of page 236.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Big Bends

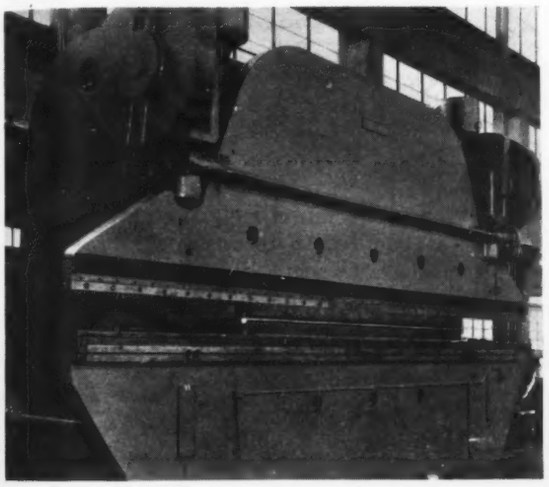
In the production of open cylindrical shells for pressure vessels and other containers, also heavy structural and machine members, 500 Series Cincinnati Press Brakes have the capacity for curving and bending these heavy plates.

Kinking the edge of heavy plate preliminary to rolling is another job where these large Cincinnati Press Brakes are effecting material savings.

If you have a "heavy plate" problem, the capacity, power and performance of a 500 Series Cincinnati Press Brake may solve it for you.

Write for engineering recommendations and Catalog B-2.

This 500 Series Cincinnati Press Brake has over twenty feet clearance between housings. Capacities: Twenty-five feet of ¾" plate or shorter lengths of 1½" plate as shown below.



Courtesy of Nordberg Manufacturing Co., Milwaukee, Wis.

special features—a power selector for stepping up the electric current, thereby increasing the magnetic holding power, and a new magnetizing and demagnetizing switch with correct timing for the demagnetizing operation and with automatic return to the "off" position. Low-voltage, direct current is employed to eliminate inductive kick-back. 96

Barnes Equalized "Roto-Blade" Pump

The John S. Barnes Corporation, 325 S. Water St., Rockford, Ill., has announced another important addition to its line of hydraulic structures and units, designated the Barnes equalized "Roto-Blade" pump. Outstanding features of this pump include quiet operation, high efficiency, long life, minimum maintenance costs, and working pressures up to 1000 pounds per square inch under continuous operation or up to 1500 pounds per square inch when operated intermittently. This pump has been especially developed to effect major savings in the initial cost of equipment through the simplification of circuit design and greater compactness for a given speed and power output.

The pump is available in many combinations, being furnished in a single pump design or as a double pump, single pump with feed pump, double pump with feed pump, and single pump with gear pump. Capacities of the pump range from 8.5 to 50 gallons per minute. 97

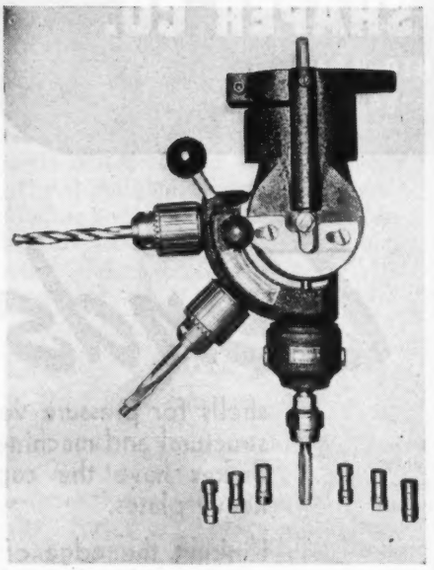


Fig. 1. Universal Three-position Turret Head Equipped with Reversing Tapping Head

Fig. 2. Tapping Head for Standard Drill Presses Built by the Universal Engineering Co.

Turret Tapping Head

The Universal Engineering Co., 2230-32 National Ave., San Diego 2, Calif., now offers the trade a reversing tapping head in one of the stations of the company's three-position drill press turret head, as shown in Fig. 1, and a new tapping head of the same design for use on standard drill presses, as shown in Fig. 2. This tapping head is of the positive clutch type drive. Drive dogs are made of chromium-vanadium steel, hardened to obtain toughness and long wear. A collet type chuck made from chromium-molybdenum steel was adopted to insure accuracy and rigidity. Collets for all size taps from No. 8 through 1/2 inch are furnished with the tapping head. The collet chuck and its spindle are made in one piece to insure accuracy and to prevent any whipping action of the tool.

The tapping head is designed for high-speed operation, and has a capacity for No. 8 to 1/2-inch taps when working in brass; No. 8 to 3/8-inch taps in cast iron; and No. 8 to 5/16-inch taps in steel. This head is available as a unit to fit turret heads now in use, as a component part of the company's new turret tapper, and as a single unit tapping attachment for all popular model drill presses. 98

Equalized "Roto-Blade" Pump Made by John S. Barnes Corporation

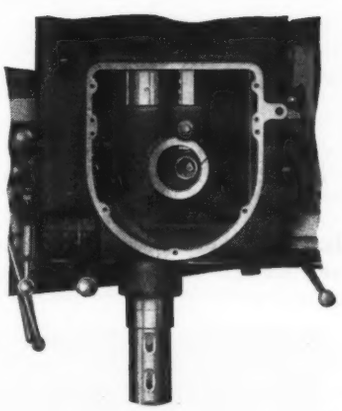
Carbide-tipped End-mill Developed by the Nelco Tool Co.

Nelco Carbide-Tipped End-Mill

Development of a carbide-tipped three-flute end-mill for use on all types of alloy steel, cast iron, brass, bronze, and plastic materials has been announced by the Nelco Tool Co., Inc., 370 Hamilton Ave, Brooklyn 31, N. Y. The new end-mill is capable of taking a plunge cut in solid metal, and has also proved particularly effective in milling plastics.

It is designed to provide more chip room, so that cooler and freer milling will result and the possibility of overheating or twisting the work will be reduced. It is also constructed to eliminate chatter, so that

To obtain additional information on equipment described on this page, see lower part of page 236.



The spindle is supported in the head by a 17½" bearing honed to fit the chrome plated spindle sleeve.

The Bickford spindle stays accurate.

Equal Efficiency of Every Unit Makes the Balanced Machine.

A precise and important operation—drilling eccentric cranks—at the American Locomotive Company Plant in Schenectady. These long holes must parallel the center lines of two bearings.

Consistently accurate performance was needed on the job—the Cincinnati Super Service Radial gave the outstanding accuracy and power required.

Write for detailed Bulletin R-24A.

See our Condensed Catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

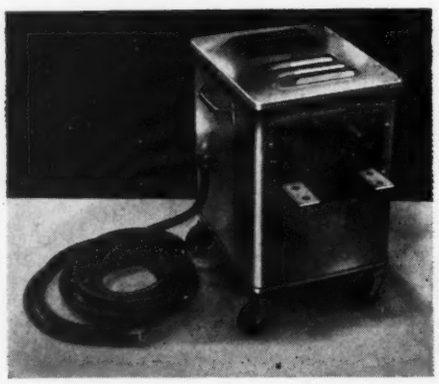
smoother cuts are obtained and the need for finishing cuts is reduced. Sizes range from 3/8 inch to 2 inches in diameter. 99

Westinghouse Portable Brazers

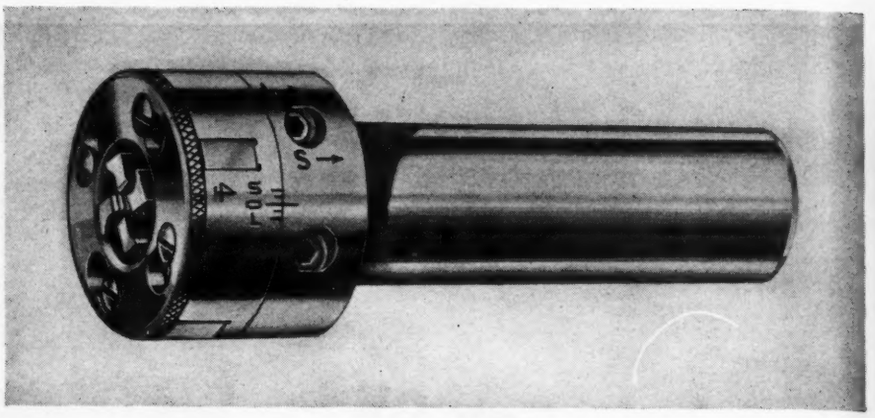
The Westinghouse Electric Corporation, Pittsburgh 30, Pa., has announced a new portable 10-KVA brazer with air-cooled tongs adapted for general brazing service in joining copper or copper-alloy parts which can be brought together between the tong jaws. This single-phase 60-cycle unit weighs 100 pounds, and is provided with four large caster type wheels and two handles, as shown in the illustration. The brazing unit is ready for operation as soon as it is connected with a 220- or 440-volt line. Alternating current from an adjustable-voltage transformer passes through the tongs and parts to be brazed.

The transformer with the line contactor is enclosed in a sheet-metal case. The brazing voltage can be changed to 12, 10, or 8 volts by means of a two-pronged plug-in switch. The panel has a control switch and outlets for brazing cables and foot-switch cable.

In addition to the 10-KVA brazer, this company has brought out a new 20-KVA portable brazer with water-cooled tongs designed for general brazing service. Enclosed in a circular steel housing, this entire unit is self-contained, having a contactor for energizing or de-energizing the brazing circuit, an adjustable-heat air-cooled brazing transformer, and a water-cooling system for the tong cooling water. Being only 24 inches in diameter it can be lowered through hatches and manholes. The unit requires only connection to a 220- or 440-volt power source.....100



Westinghouse 10-KVA Portable Brazing Machine



Improved Geometric Die-head

Geometric Die-Head of Improved Design

Important improvements made recently in the Style EJ5 die-head manufactured by The Geometric Tool Company, New Haven 15, Conn., have simplified the construction of this tool and considerably reduced its weight. This improved die-head, being more compact, can now be fitted into a much smaller space on any machine for which it is designed. Greater accuracy is also obtainable in producing threads within its tapping capacity of 1/16 to 3/16 inch as a result of improvements in design. In order to enable this die-head to operate with maximum speed and accuracy on Swiss type automatics in the production of threaded parts for watches, clocks, cameras, and all kinds of small precision instruments, the designers of The Geometric Tool Company worked in close cooperation with several manufacturers of the Swiss type automatic machines.

Easier and quicker assembling and disassembling of the die-head are made possible by the use of steel retaining rings. The rigid shank of the new type tool fits the spindle and is driven by a cross-pin, held in position on both sides of one steel ring, while the other retaining ring holds the assembled parts securely in place. The new die-head has a shorter shank and is smaller in outside diameter than the old type. Over-all length of the new type is much less than that of the old, and the weight of the new die-head is only 2 ounces, compared with 3 ounces for the old type.

The die-head is now regularly equipped with the standard improved forward floating shank, which can be applied directly to the turret of the No. 00 or the No. 00G Brown & Sharpe automatic screw machine without the use of special holders. The longer bearing surface of the new design prolongs the life of the tool. The new EJ5 die-head is also made with a rigid shank and is sold to manufacturers for their aligning type holders. The die with threaded back part for use on the 00G Brown & Sharpe automatic screw machine is also available. High-speed ground-thread chasers are now furnished as standard equipment in all types of the EJ5 3/32-inch projection die-heads, which facilitate cutting close to a shoulder and give smoother threads of greater accuracy. All of these heads can be used for cutting left-hand threads with left-hand chasers.

A special feature of these heads is the diameter adjustment, by means of which the chasers can be easily set to cut within close tolerances by merely loosening the four front-plate screws, and then loosening one adjusting screw and tightening another. 101

Daniels Precision Reamers

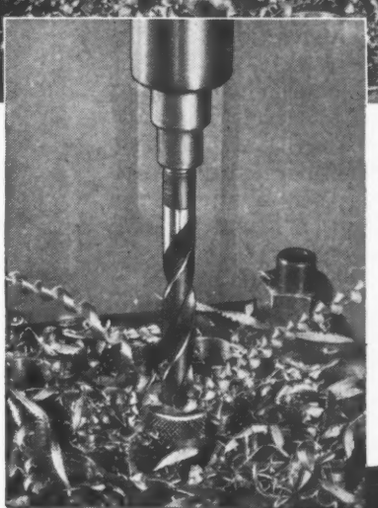
The N. J. Daniels Tool Co., Inc., Haverhill, Mass., has brought out a new line of hand and chucking ream-

Precision Reamers Made by N. J. Daniels Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 236.

More Speed... LONGER DRILL LIFE WITH CONTINENTAL'S New DRILL CHIP BREAKER

● **Faster drilling action and prolonged tool life are but two of many advantages obtained with the Continental Drill Chip Breaker. By breaking chips into small, uniform pieces that are easily carried up the flutes of the drill, clogging is eliminated. The unit can be used vertically, horizontally, or at any angle as long as the housing can be kept stationary while the drill rotates. The arm prevents rotation of the housing. Where space permits, the Continental Drill Chip Breaker can be used in multiple spindle heads.** ***Write for Continental Bulletin 28161 today for sizes and complete specifications.***



Above: With the Continental D
Chip Breaker, the chip is brok
at regular intervals. Small loo
chips are easily carried up
flutes. Holes are straighter, rou
er, and have better wall fini

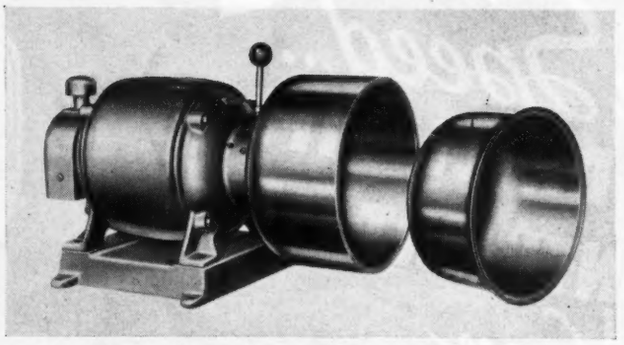
Left: With conventional drillin
solid chips pack the drill flut
causing scratched, out-of-rou
and crooked holes. The drill m
be withdrawn repeatedly to cl
flutes and avoid drill breaka

YOU PROFIT 7 WAYS WITH CONTINENTAL'S DRILL CHIP BREAKER

1. **GREATER SPEED**—Because there is no clogging, it is not necessary to withdraw the drill to clear chips from the hole.
2. **PROLONGED TOOL LIFE**—The free cutting action results in more holes being drilled before sharpening is necessary.
3. **BETTER FINISH ON HOLES**—Holes are round, straight, and smooth. The short chips travel up the drill flutes without scratching or clogging.
4. **DEEPER HOLES**—It is possible to drill holes many diameters deeper, eliminating the necessity of withdrawing the drill from hole to relieve chips.
5. **AUTOMATIC FEED**—Automatic feed can be used without the danger of drill breakage that so often results from chip-clogged holes.
6. **GREATER SAFETY**—There are no long, whirling, spiral chips to burn hands or cut fingers.
7. **CLEANER OPERATION**—Coolant penetrates easily to the very point of the drill; the short chips do not splash it on machine or operator.

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
1200 OAKMAN BOULEVARD • DETROIT 6, MICHIGAN

ers, including straight- and spiral-fluted types made from carbon and high-speed steel, which are accurate to 0.0002 inch. These precision reamers are available in sizes varying by 1/16 inch from 1/4 inch to 2 inches. Sets of these reamers covering various size ranges are available in hardwood cases to suit the needs of toolmakers and machinists, as well as for tool-room use. Individual reamers are furnished in transparent plastic tubes to provide protection for the cutting edges and to permit selection of the proper type and size without unwrapping or handling the reamers. 102

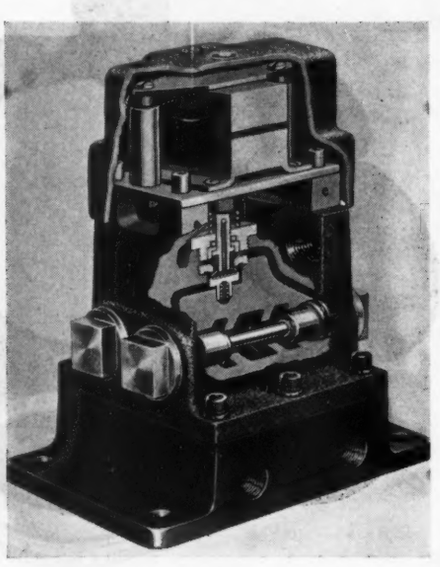


Vacuum-grip Speed Lathe Brought out by the Crozier Machine Tool Co.

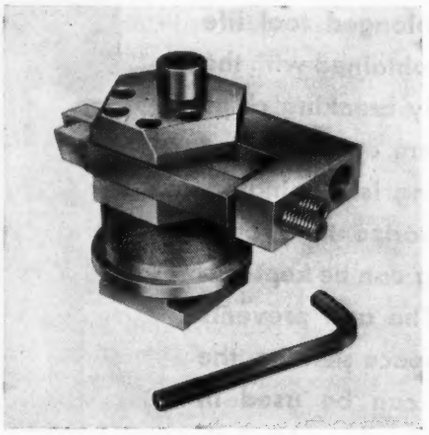
Ross Solenoid-Controlled Air Valve

A new piston poppet type valve has just been brought out by the Ross Operating Valve Co., 6494 Epworth Blvd., Detroit 10, Mich. This pilot-operated and solenoid-controlled air valve is comparatively small and compact. It is of rugged construction, and can be operated at speeds up to 400 cycles per minute with a current consumption of 1.2 amperes at 110 volts, 60 cycles.

The working parts of this valve are interchangeable. By simply removing the two end plugs, it is possible to replace the piston poppet assembly without removing the valve or disturbing any of the piping. This valve is available in three-way normally open or closed style; four-way; and four-way, five-port types in 1/4-, 3/8-, 1/2-, and 3/4-inch sizes.....103



Solenoid-controlled Air Valve Made by Ross Operating Valve Co.



Howard Tool-holder with Adjustment Block

Howard Tool Adjustment Block

A tool adjustment block for use with Howard tool-holders has just been announced by Howard Dearborn, Inc., 3370 W. 140th St., Cleveland, Ohio. This block can be mounted on either side of the holder, and has set-screws for adjusting either tool when combination tooling is employed.

The slot design of the block facilitates changing tools or adjusting the angle of the tool setting without changing the position of the toolholder. The holder is easily installed for right- or left-hand turning.....104

Crozier Vacuum-Grip Speed Lathe

A new model, heavy-duty, vacuum-grip speed lathe with a built-in wet vacuum pump which holds workpieces without chuck or collet has been announced by the Crozier Machine Tool Co., 654 N. Prairie Ave., Hawthorne, Calif. Without the use of piping or glands, this patented pump generates its own vacuum which holds the work securely when the lathe is in motion and releases it instantly when the machine is stopped. Starting and stopping of the spindle are accomplished through an ingenious patented mechanical brake and switch controlled by a single lever.

The vacuum seal is created by drawing oil from a large reservoir into the pump during the early portion of the vacuum creating cycle. The oil, being recirculated, requires only occasional replenishment.

This speed lathe is adapted for holding both small and large work, and will handle metal, plastic, rubber, wood, or glass pieces. It is suitable for such operations as lens grinding, utensil polishing, disk-valve grinding, trimming rubber products, removing flash from plastic products, machining copper disks, and polishing novelties. The lathe is driven by motors of two or three phase, 220, 440, or 550 volts, 50 or 60 cycles, running at speeds ranging from 600 to 3600 R.P.M. 105

Cleveland Indexing Head

A new model indexing head capable of holding all straight- or taper-shank tools from 1/16 inch through 1 1/2 inches in diameter for resharpening or grinding has

Indexing Head Made by Grinders & Fixtures, Inc.

To obtain additional information on equipment described on this page, see lower part of page 236.

Costs Count IN THE AUTOMOTIVE INDUSTRY! - SO

CARBOLOY STANDARDS get the call!

CEMENTED CARBIDE

Style T-15 · Style T-12 · Style T-1 · Style T-4 (Style T-7, left hand) · Style T-13 (Style T-14, left hand) · Style T-5 (Style T-9, left hand) · Style T-10 (Style T-11, left hand)

Carboloy Tools Stay On the Job Longer in Continuous Production — Hold Close Tolerances — Produce Top-Quality Finish.

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In *Every* Industry, 60 to 80% of the Carbide Tool Needs Are Met By These 11 Standard Styles

Carboloy Standards are "master" styles, designed to handle most of your turning, facing and boring jobs. For special requirements, they may be quickly ground to the desired shape. They save stocking a large inventory of special tools, and let you tool up immediately on most jobs. Equally suitable for metals and non-metallics. And actually priced lower than ordinary tools in many sizes. Write today for Catalog GT-175R

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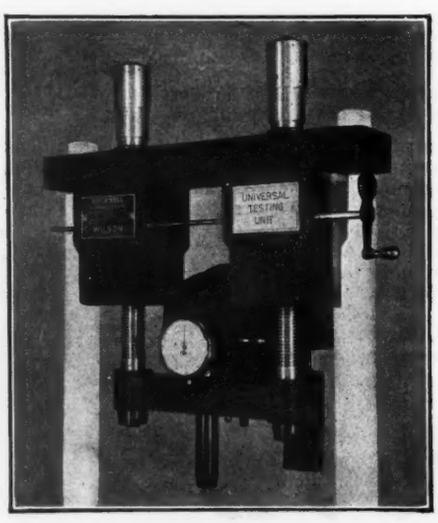
been developed by Grinders & Fixtures, Inc., 1255 W. Fourth St., Cleveland 13, Ohio. This model, designated as Cleveland No. 1 1/2 index-head, was developed around recommendations received from various tool users for an index-head that would accommodate all tools in this size range.

The head rotates 360 degrees in each of three planes, on a universal center. Quick-set, positive locking devices hold the tool at any desired angle. An indexing gear permits the re-establishment of concentricity on tools where one or more cutting edges have been unduly worn or damaged. 106

Wilson Universal Hardness Testing Unit

A universal hardness testing unit designed for heavy and large work which cannot be readily handled in standard-size Rockwell hardness testers or the Rockwell superficial hardness testers has been developed by the Wilson Mechanical Instrument Co., Inc., 383 Concord Ave., New York, N. Y. This equipment comprises a standard testing unit which can be mounted in a rigid frame of any design, constructed by the user to meet his particular testing requirements.

The company supplies only the unit that appears in the dark portion of the illustration; the phantom section is merely the frame in which the unit is mounted for standardization work, and is replaced by a rigid supporting frame in use. Large gears, rollers, and other large heavy pieces can be successfully handled on this machine. 107

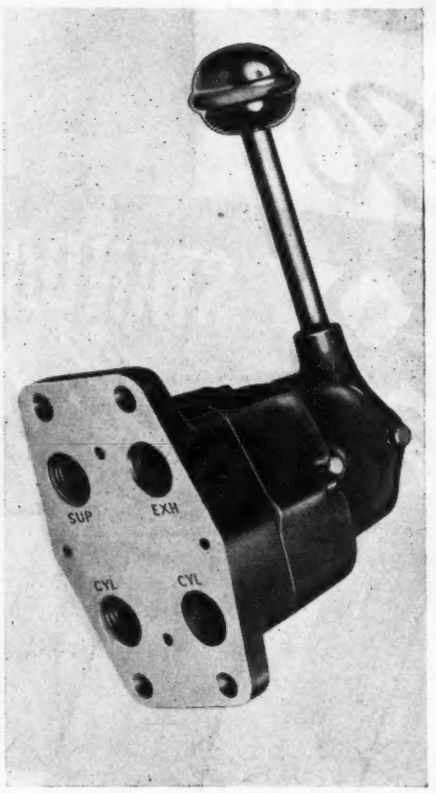


Wilson Hardness Testing Unit

Four-Way Air Control Valve

Numatics, Milford, Mich., has added a new H-4 series four-way, hand-controlled air valve to its line of operating valves for compressed air. This valve is a full-ported poppet type having two poppets instead of the usual four. All ports are on one face with both outlets located at one end to facilitate piping.

All working parts of this valve, including the operating lever, are contained in an upper housing which can be lifted from the main base by simply removing four socket-head screws. This arrangement facilitates servicing without disturbing the pipe connections. The valve is available in six pipe sizes ranging from 1/4 inch to 1 1/4 inches for either locking or non-locking operation. 108

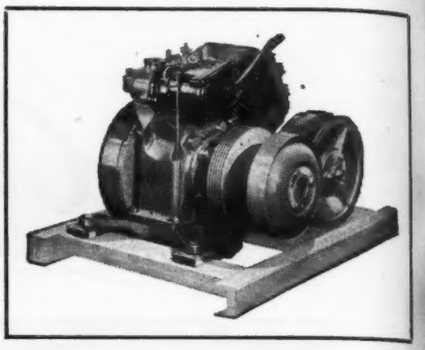


Numatics Four-way Air Control Valve

Salsbury Automatic Transmission

A completely automatic driving unit in which the drive ratios are controlled by the driven unit and the clutch engagement is controlled by the engine speed is built by Salsbury Motors, Inc., 4464 District Blvd., Los Angeles 11, Calif. This transmission consists primarily of a variable-diameter drive pulley, a variable-diameter driven pulley, and a V-belt. These units form a coordinated assembly which gives automatic, infinitely variable ratios over a 4 to 1 range. Normal over-all reductions may range from 4 to 1 down to 1 to 1 for light-duty, high-speed units, and from 200 to 1 to 50 to 1 for heavy-duty, low-speed requirements. The transmission may be originally assembled to limit the engine speed automatically to any desired value under normal operating conditions.

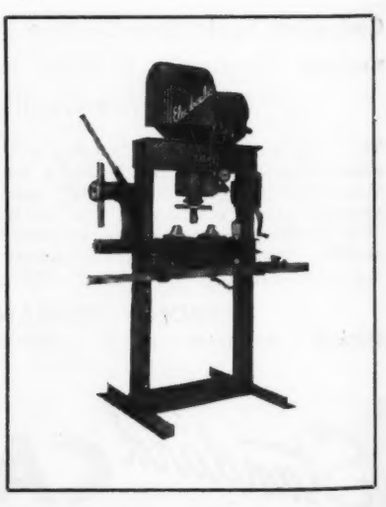
A Salsbury Model 600, single-cylinder, four-cycle, air-cooled engine, developing 6.5 H.P. at 3200 R.P.M. and weighing only 56 pounds, is used in this drive. 109



Automatic Transmission Unit Built by Salsbury Motors, Inc.

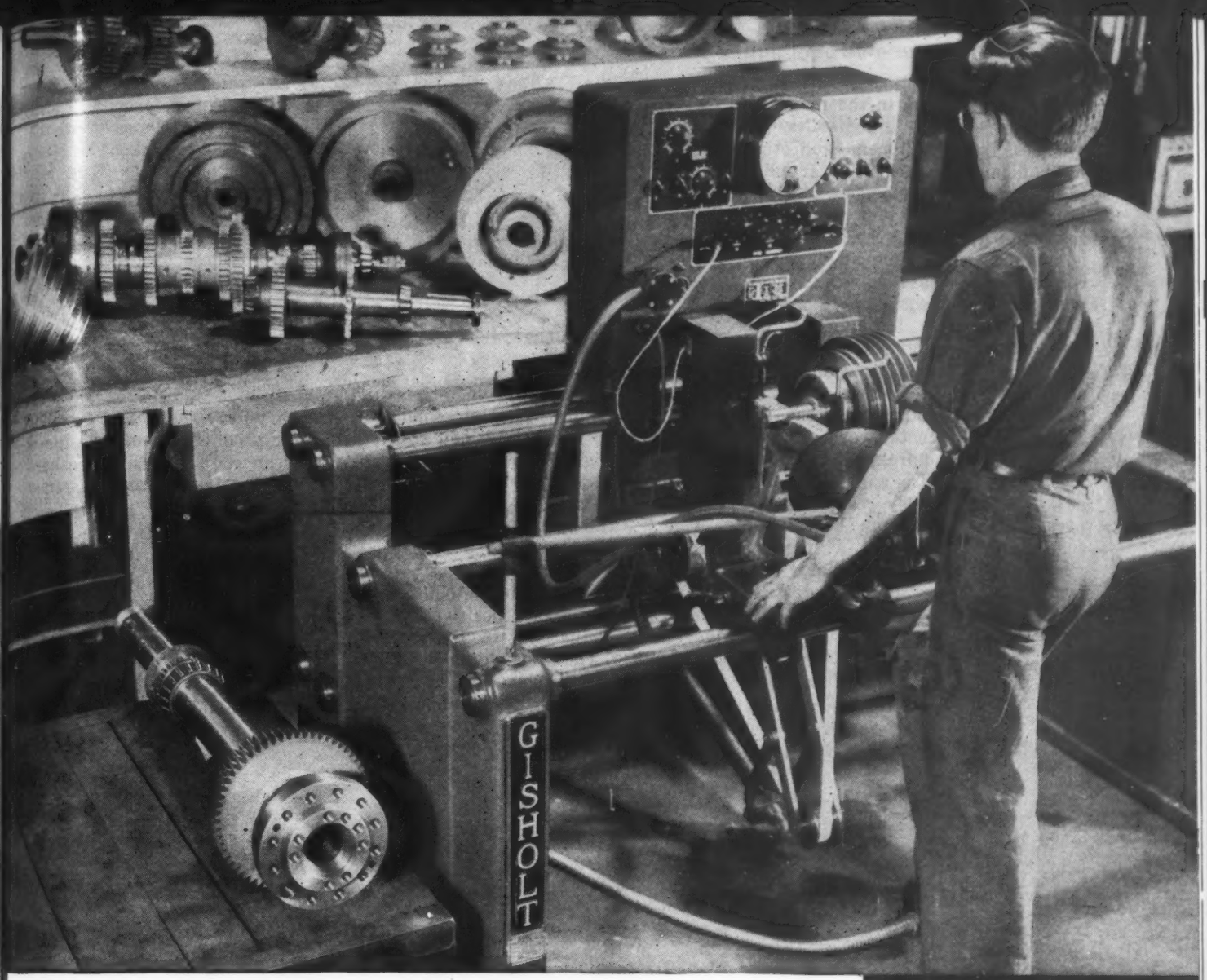
Dake Electric-Hydraulic Press

An electrically operated hydraulic press called the "Elec-draulic" has just been announced by the Dake Engine Co., Grand Haven, Mich. This press is designed for assembling, straightening, bending, forming, and



Dake "Elec-draulic" Press

To obtain additional information on equipment described on this page, see lower part of page 236.



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Dynetric Balance

TO A WIDE VARIETY OF PARTS!

Look at this variety of parts—all sizes and shapes—and all in the day's work for a Gisholt Dynetric Balancing Machine*. One minute it's spotting the unbalance in a machine tool spindle . . . now, with a quick adjustment, it's pointing out corrections for a drive pulley. Bearings, clutch parts, gears—Gisholt Dynetrics take them all in stride! A simple dial reading tells the story, as unbalance vibrations down to .000025" are *located, measured,* and *readied for correction.*

Take no chances with destructive vibration! Gisholt makes it easy and economical to balance any rotating assembly from a fraction of an ounce to many tons. Write for complete information!

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SPECIAL MACHINES

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Keep Ahead . . .
with Gisholt

pressing operations in the manufacture and repair of automobiles, appliances, farm equipment, and other mechanical products. It is supplied in 50- and 75-ton capacities. Any desired working pressure within the respective ranges of these machines is instantly obtainable by finger-tip control and release valve, no hand pumping being required.

The operating features of the press include a variable ram speed —from 0 to 6 inches per minute— and a work-head which is easily moved to any point along the top channels for off-center work. A dump valve protects the press against overload. The pressure gage is located at eye level for easy reading. The press table height can be quickly changed by means of a hoisting crank. Quick-action auxiliary ram return on release of the pressure valve speeds up operations. 110

Lovejoy Flexible Coupling

Lovejoy Double-Flex Coupling

A new coupling for oil burners and air-conditioning units, which is also applicable to many other machines requiring couplings of maximum flexibility, has been developed by the Lovejoy Flexible Coupling Co., 5009 W. Lake St., Chicago 44, Ill. This compact coupling is designed especially for easy installation and dependability. The standard L-R body of this coupling is permanently inserted into a molded synthetic rubber unit. The coupling is made in six sizes, with lengths ranging from 2 1/4 to 5 inches. 111

Elgin Sapphire-Tipped Micrometer

The Sapphire Products Division of the Elgin National Watch Co., 932 Benton St., Aurora, Ill., has placed on the market a new outside

Elgin Sapphire-tipped Micrometer

micrometer having a sapphire-tipped anvil and spindle. The micrometer is available in 1-inch to 6-inch sizes, and with either English or metric system graduations. Its accuracy is guaranteed to within 0.0001 inch.

The features of this micrometer include adjustable-spindle bushing; hollow, light-weight frame; stabilized steel throughout; tool-steel ground spindle thread; positive locknut; and graduations in ten-thousandths inch. The first micrometer of this type to be produced is in constant use in a drill plant, and has been employed for more than 2,000,000 production gagings without showing appreciable wear. 112

Moore Leaf Taper Gages for Measuring Hole Diameters

A complete set of thirty-six direct-reading leaf taper gages, packed in a plastic box as illustrated in Fig. 1, is a recent development of the Moore Special Tool Co., Inc., 734 Union Ave., Bridgeport 7, Conn. These gages are graduated in thousandths of an inch and are accurate to 0.00025 inch. The complete set of gages covers a hole-measuring range of from 0.095 inch to 1.005 inches.

These gages, used in the manner illustrated in Fig. 2, provide a simple, effective means of measuring the exact size of each cut taken in boring or grinding a hole to size. Each leaf gage is arranged numerically in its individual slot, and is properly labled. The graduations on each size gage overlap those of the next size by 0.010 inch. 113

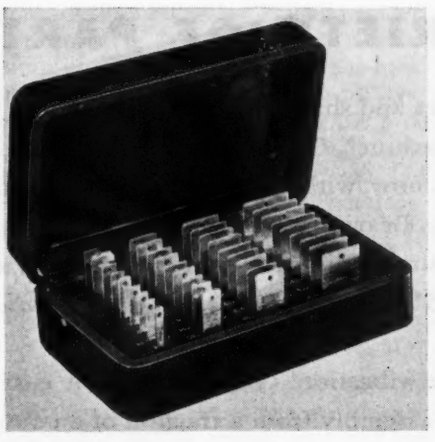
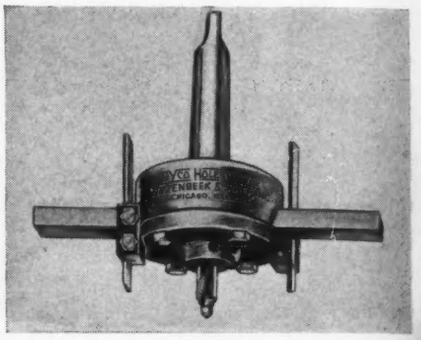


Fig. 1. Moore Direct-reading Leaf Type Hole-measuring Gages in Plastic Box

Wyco Heavy-Duty Hole and Washer Cutter

A heavy-duty hole and washer cutter for production work, designed to cut clean round holes or washers from steel plate or other material



Wyco Hole and Washer Cutter

up to 1/2 inch thick, is being placed on the market by Wyzenbeek & Staff, Inc., 838 W. Hubbard St., Chicago 22, Ill. This tool is said to cut to size as accurately as a boring tool.

The tool-holders and body are of heavy steel and of extremely rigid design. Balanced, accurate cutting is assured by two standard high-speed cutting-off blades and a 1/2-inch hardened pilot-pin. The tool is provided with a 7/8-inch hexagonal

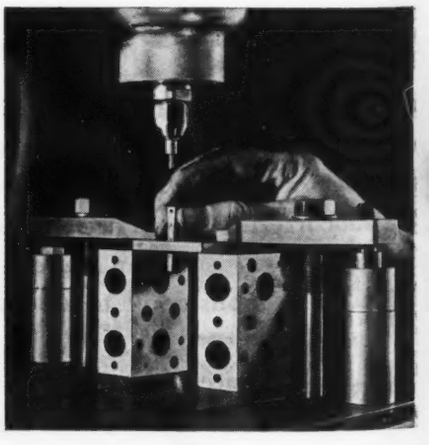


Fig. 2. Method of Using Moore Leaf Gage for Checking Depth of Grinding Cut

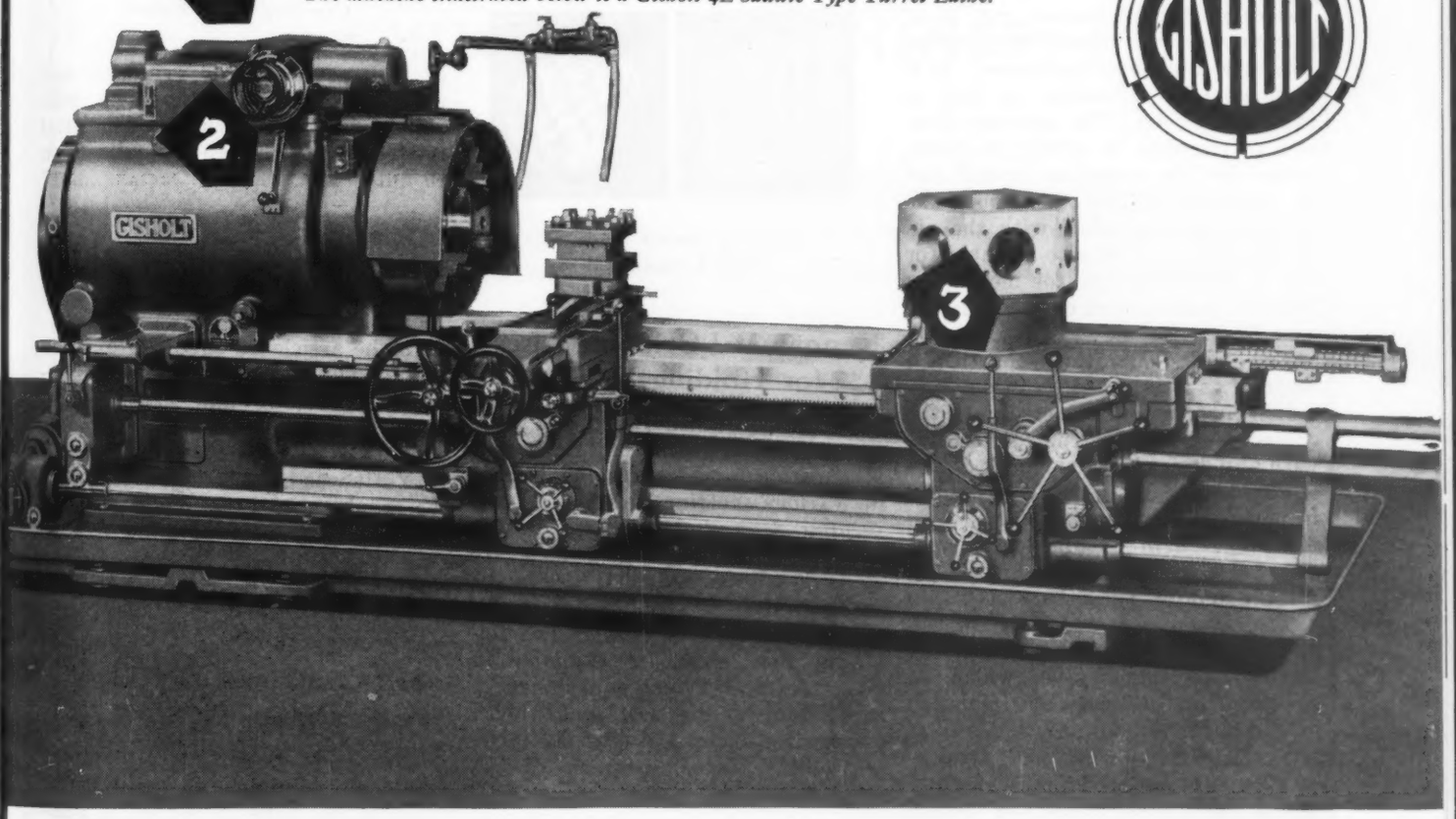
To obtain additional information on equipment described on this page, see lower part of page 236.

3 ways to increase production

Actual cutting time on a turret lathe is usually determined by using the maximum speeds and feeds the cutting tools will withstand. Isn't it true, therefore, that the greatest opportunity for time-saving is in cutting the lag between cuts?

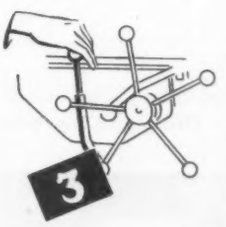
By substituting automatic operation for certain manual motions, Gisholt Turret Lathes have made it possible to increase the percentage of actual cutting time in relation to the complete cycle. This means increased production—lower machining costs.

The machine illustrated below is a Gisholt 4L Saddle Type Turret Lathe.



Spindle speed changes can be made instantly without stopping the spindle or releasing the main drive clutch. The Gisholt Hydraulic Speed Selector, power operated, eliminates manual gear shifting. It may be operated either direct or pre-set.

Hydraulic spindle control provides for starting, stopping or reversing by a mere touch of this handy lever. When in neutral position, braking is automatic, bringing the spindle to a quick, smooth stop. Headstock control is as easy as pressing buttons.



Power rapid traverse for both hexagon and square turrets insures quicker movement of tools in and out of cutting position. With transverse travel of the cross slide, time savings are substantial on many jobs. Operating effort is reduced to a minimum.

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TURRET LATHES - AUTOMATIC LATHES SUPERFINISHERS BALANCERS SPECIAL MACHINES

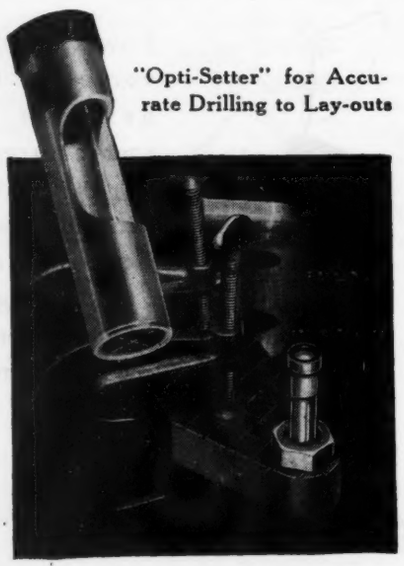
shank to fit any 1-inch drill chuck or with No. 3 or No. 4 Morse taper shanks. Extra blades are available for the tool. 114

"Opti-Setter" for Accurate Drilling to Lay-Outs

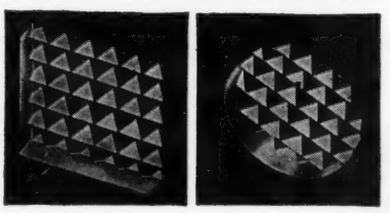
A low-cost optical centering tool designed for use wherever drilling operations are performed is being manufactured by the Benton Co., 351 S. La Brea Ave., Los Angeles 36, Calif. This device, which is small enough to be carried in the vest pocket ready for instant use, is of convenience to machinists, set-up foremen, and home craftsmen. It is applicable to individual as well as production jobs. The accurate location of templets in relation to workpieces and the centering of drill jigs to reference marks or lay-outs can be easily accomplished with the aid of this setter. It is also suitable for use in special set-ups for measuring between points, work edges, or reference lines.

For drilling operations, this "Opti-Setter," as it is called, is inserted in a drill jig which is adjusted until the cross-lines in the instrument coincide with any desired lay-out mark on the work. The drill jig is now clamped in position and the "Opti-Setter" removed. A drill bushing of correct size can then be inserted in the jig for the drilling operation.

The instrument consists of an aluminum barrel, finished to size on the outside diameter, in which an eye-piece and reticule are mounted on the upper and lower ends, respectively. The reticule consists of a disk of ground and polished optical glass, which has two extremely fine scribed interrupted cross-lines exactly centered with the precision-finished barrel. The cross-lines are viewed through a magnifying eye-piece, and are illuminated through a large window in the side of the barrel, which is sealed to prevent the entry of dust by a clear plastic material. For abnormal viewing positions, an auxiliary eye-piece is available, which permits easy sighting of the image at right angles to the normal line of vision. The "Opti-Setter" is supplied in two sizes—1/2 inch in diameter by 3 inches long, and 3/4 inch in diameter by 3 inches long. 115



"Opti-Setter" for Accurate Drilling to Lay-outs



Gripping Inserts Made of Solid Kennametal

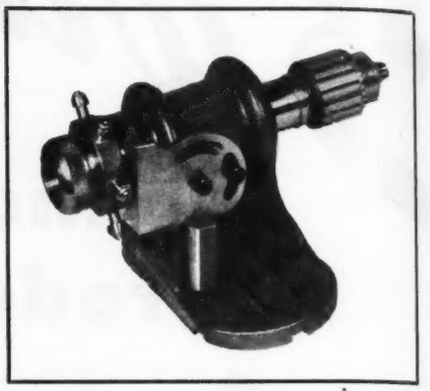
Kennametal Gripping Inserts for Holding Devices

Kennametal Inc., Latrobe, Pa., is now producing a line of "Kengrips" for use as durable gripping inserts in various holding, clamping, and feeding devices. As shown in the illustration, "Kengrips," which are made of solid Kennametal, are in the form of disks and squares with diamond serrated surfaces. The following four sizes are available in either form: 1/2 inch square or 1/2 inch diameter by 1/8 inch thick; 5/8 by 1/8 inch; 3/4 by 5/32 inch; and 1 by 5/32 inch. 116

Govro-Nelson Axial Relief Grinding Fixture

An axial relief grinding fixture adaptable to an exceptionally wide range of operations has recently been placed on the market by the Govro-Nelson Co., 1931 Antoinette, Detroit 8, Mich. This fixture is especially well suited for grinding cutting edges, steps, flutes, and chip relief on milling cutters, burring tools, counterbores, countersinks, end mills, reamers, drills, and taps, performing many operations which formerly required a variety of grinding fixtures.

All adjustments are simple, visual, and external, the fixture being instantly convertible from right- to left-hand operation and vice versa. It can be used on surface grinders, as well as on cutter grinders, and performs most grinding jobs with standard grinding wheels. The axial relief is automatically equalized on all flutes. 117



Govro-Nelson Fixture for Grinding Axial Relief

"Grip-Slide" Threading and Tapping Tool

In the article on page 220 of June MACHINERY that described the "Grip-Slide" threading and tapping tool made by the Threadmiller Corporation, 17 E. 42nd St., New York 17, N. Y., it was erroneously stated that the regular model tool has a capacity for cutting threads ranging in size from 2–56 to 5/8 inch in steel; the correct range is 2–56 to 3/8 inch.

* * *

Self-Contained "Package" Power Plants

The designers of steam power plants of the Westinghouse Electric Corporation have developed a compact power plant which is called a "package" plant. It consists of a complete power generating unit—steam turbine, alternating-current generator, steam condenser, and all auxiliaries, such as pumps, mounted on a single bedplate. In fact, the condenser provides the foundation for the turbine generator and auxiliaries. This unit develops 5000 K.W. and occupies a floor space of 13 by 31 feet. It stands 12 1/2 feet high.

This package power plant is very close to being a plug-in unit. After it has been set on prepared supports and the water, steam, and electrical connections have been made, it is ready to produce power. The simplicity of installation was one of the prime factors that led to its design. It will have its greatest use where erection facilities are lacking.

Practical help for prospective buyers of

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NEW BRITAIN AUTOMATICS

SCREW MACHINES
CHUCKING MACHINES

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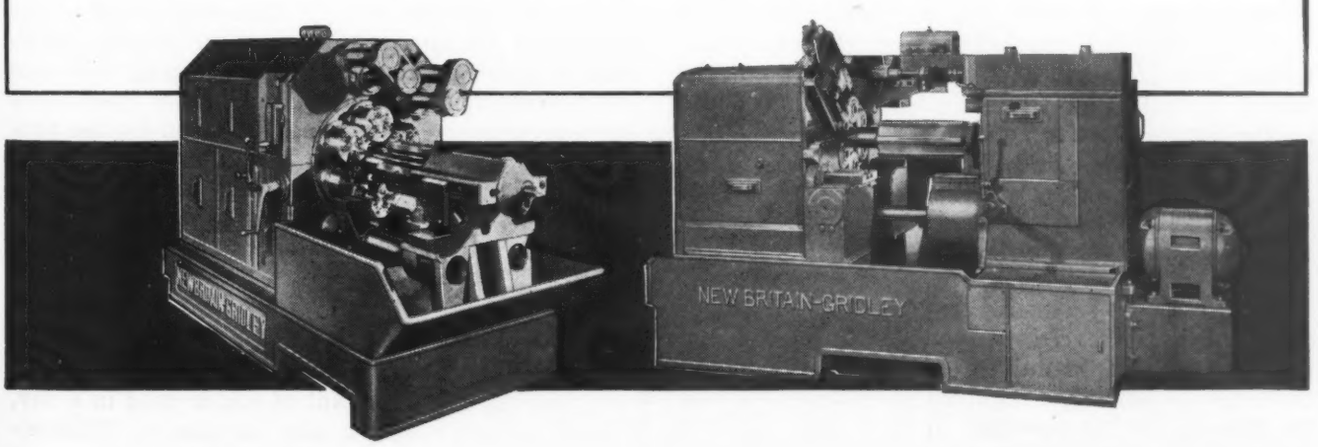
As government owned plants are declared surplus, large batteries of machine tools are becoming available to the public. Among these are NEW BRITAINS with many remaining years of useful productivity. If you are interested in acquiring any of these, contact our nearest representative or our home office.

As an approved dealer for the War Assets Corporation, we stand ready to help prospective buyers of NEW BRITAIN Automatic Screw Machines and NEW BRITAIN Automatic Chucking Machines, to the end that maximum satisfaction is realized from such purchases.

A qualified New Britain representative will work with you in locating the type of machine desired, join you in an inspection and advise you insofar as possible as to its condition and suitability for your needs.

With identifying serial number, our home office can advise as to equipment originally shipped with the machine, and furnish you engineering assistance in adapting it to your work . . . At the same time, we can advise as to cost of any necessary equipment needed to meet your requirements.

Consult our nearest field representative or our home office for further details.



NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

Detroit Meeting of A. S. M. E. Features Metal Cutting

AT the semi-annual meeting of the American Society of Mechanical Engineers, held in Detroit, Mich., June 17 to 20, metal-cutting processes, machine shop practice, and machine design were subjects specially featured on the program. Several sessions were held dealing with various phases of work in these fields.

Under the auspices of the Production Engineering Division of the Society and the Research Committees on Metal Cutting and Cutting Fluids, papers were read on production problems in connection with improved cutting tools; cutter life obtained from carbide blanks mechanically held versus those brazed to cutter blades; carbide tooling at the New York Navy Shipyard; influence on tool life and power of chamfer, nose radius, and peripheral cutting angles when face-milling cast iron having a tensile strength of 40,000 pounds per square inch; studies pertaining to tool wear, chip characteristics, and surface finish of free-cutting steels; results of investigations on the removal of metals by grinding; and a review of new developments in honing.

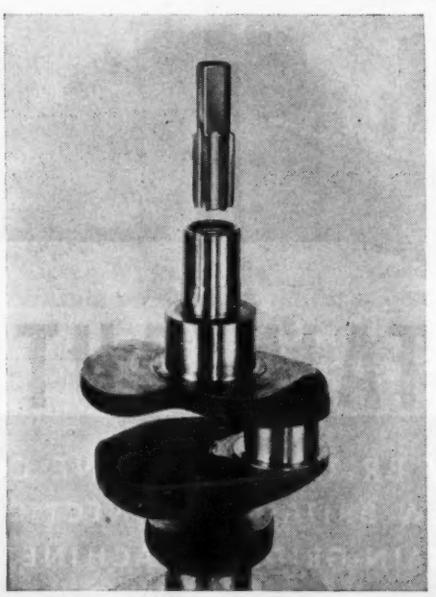
Under the combined auspices of the Production Engineering Division and the Division of Metals Engineering, a broad range of subjects on welding was treated, covering heliarc welding; resistance welding with storage batteries; arc-welding of alloy steels; and photo-electric investigation of residual stresses in welds. The Production Engineering Division, in addition, had a session dealing with high-frequency induction heat-treating of both conducting and non-conducting materials. The Research Committee on Metal Cutting and Cutting Fluids had a session on the effects of the metallurgical structure on the machinability of cast iron; the distribution of hardness in chips and machined surfaces; and the cutting action of reamers. The Metals Engineering Division had a separate session on centrifugal casting of cast iron and tool steels, and on high-temperature alloys.

The Machine Design Division held a session dealing with helical spring design, high-speed chain developments, and self-locking nuts for industrial equipment. In addition, the meeting had sessions on management, aviation, oil and gas power, variable-speed drives, power, heat transfer, industrial instruments and regulators, process industries, automotive industries, noise control in aviation, education and training for the industries, materials handling, rubber and plastics, and fluid meters.

Special Taps Greatly Increase Crankshaft Threading Rate

CRANKSHAFT threading has been stepped up over 200 per cent at a large Detroit automobile manufacturer's engine plant through the use of special ground taps designed and produced by the Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11, Mich. Heat-treatment of the steel crankshaft forgings tends to develop a crystalline structure that resists cutting. Conventional taps previously employed often sheared at the tooth roots. Rapid dulling of the tools and the time required for reconditioning resulted in seriously impaired production schedules.

The specially designed ground tap distributes the cutting load over a 3 1/2 thread chamfer on each of six straight flutes. Eccentric relief of the chamfered section is minimized to provide maximum support of the cutting edges and maintain full concentricity of the thread. Tool costs were materially reduced by the production of an average of 700 pieces between grinds, and the breakage of taps was entirely eliminated.



Tapping Forged-steel Crankshaft with Specially Designed Tap Made by Detroit Tap & Tool Co.

* * *

Almost three times the amount of water used in a day, by a city the size of Philadelphia—219,000,000 gallons—is pumped daily through the steam condenser tubes of the Philadelphia Electric Co.'s Richmond power station to cool steam back to water. The mammoth condenser, built by Westinghouse, is 44 feet long, 29 feet wide, and 32 feet high—the size of a seven-room house.

Oil Exploration from Air Made Possible by "Flying Eye"

Uncharted oil resources in the earth beneath the most inaccessible ocean, jungle, or mountainous region can be "mapped" from the air, according to the Gulf Oil Corporation, by using a "flying eye," or airborne magnetometer. This device, which was developed during the war as a secret weapon for defeating enemy submarines, is said to constitute the first practical means of surveying oil from the air. It provides the fastest known method of securing geophysical prospecting data of any kind, and probably the cheapest.

In preliminary oil surveys, the magnetometer has given a continuous magnetic chart in grid style over hundreds of miles of difficult terrain in a few hours. Ground prospecting over the same area would require weeks or months.

Research on this instrument, which is basically a magnetic detector, was begun in the Gulf laboratories in 1940, and a successful test flight was made in early 1941. From then on until the end of the war, practically all uses were in the field of combat. The instrument, which is electronically operated, rides in a bomb-like casing that is trailed beneath the plane in order to eliminate magnetic interference.

Counter Chronograph Provides Fast Method of Timing in Ballistic Tests

An electronic interval timer which originates its own pulses at a regular rate of 100,000 per second is being used by the Western Cartridge Co., Division of Olin Industries, Inc., to enable ballisticians to make both velocity and accuracy tests simultaneously with a single bullet. The instrument is called a "counter chronograph." The bullet, on its way to the target, starts the chronograph counting by passing over a photoelectric cell. Counting is halted when the bullet passes over a second photoelectric cell at a specified distance beyond the first.

The electronic counting circuit of the chronograph uses the figures 1, 2, 4, and 8 in appropriate combinations to record the number of counts. Each figure is represented by a tiny neon bulb. Four columns of bulbs time in hundredths, thousandths, ten-thousandths, and hundred-thousandths of a second, respectively. Each pulse starts in the first column and moves progressively through the other columns. These four banks of lights can count 9999 pulses, the time measurement for 0.09999 second or about 1/10 of a second. This counter chronograph is a product of the Potter Instrument Co., Flushing, Long Island, N. Y.

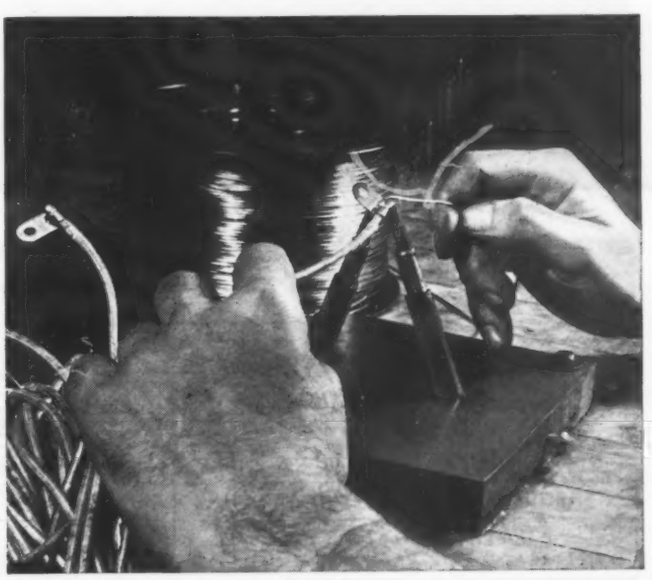
New Aluminum-Faced Office Building

A twenty-story office building to be erected by the Aluminum Co. of America at Park Ave. and 58th St., New York City, will be the first building in the world to employ a new type of construction embodying aluminum-faced walls. The entire facade, with the exception of the window areas, will be of aluminum.

On the street level, pedestrians will note a large expanse of glass which will flood with daylight a great display area housing an ever-changing exhibit of aluminum products. At the rear of the room, an aluminum-faced escalator provides facilities for reaching the second floor. Throughout the building, liberal use will be made of aluminum. The engineers and architects have been studying the possible use of movable aluminum interior partitions, thereby demonstrating the advantages that aluminum offers in adjusting office space flexibly and economically to changing needs.

* * *

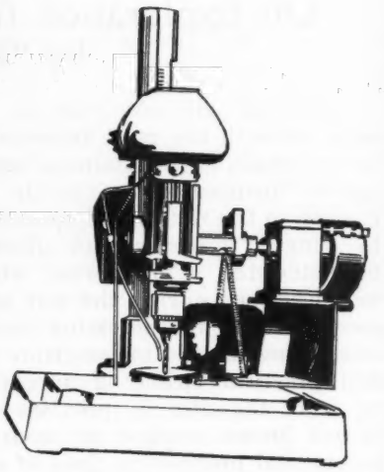
It is just as important for the United States to find a way of preventing strikes as it is for the nations of the world to devise machinery that will prevent the use of war to settle international disputes. Our lack of adequate laws and governmental machinery to handle industrial disputes is in glaring contrast to the position that the country has taken in the international field.



Two Carbon Electrodes, Mounted in a Micarta Panel as Shown, Provide a Fixture which Facilitates the Soldering of Small Parts by the Application of Electric Heat in the Mansfield, Ohio, Plant of the Westinghouse Electric Corporation. The Electrodes are Mounted at Opposed Angles in Such a Manner that They can be Bridged by Small Parts, Such as the Copper Strap Terminal Seen being Soldered in the Illustration. When Current Flows through the Terminal, the Latter is Heated to the Proper Soldering Temperature and Solder is Then Applied. A Rheostat under the Bench is Employed to Regulate the Amount of Current Used

MACHINING DATA ON PLASTICS

11. DRILLING TESTS



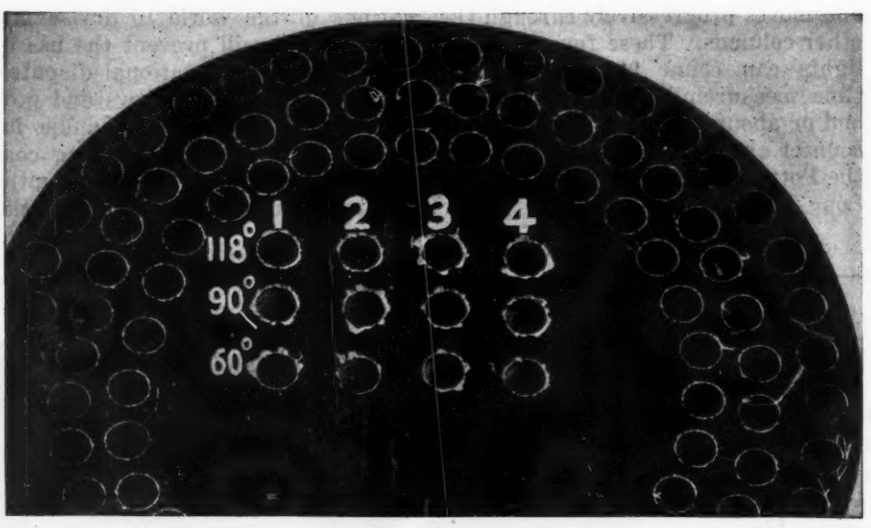
This is the eleventh in a series of messages designed to better your knowledge of the phenolics—the most versatile of all plastics . . . the type of plastics which Durez has specialized in producing for the past quarter century

To determine the qualities of drills and drilling properties of molded phenolic materials, we must consider the following factors: 1. Type of drill, 2. Angle of the cutting edge, 3. Type of material, 4. Peripheral speed, 5. Feeding method (mechanical or manual), and 6. Cooling agent.

It is extremely important to use a testing method by which the results obtained can be repeated a number of times. Only then can we be confident that the testing method used and the results obtained are dependable and accurate.

Difficulties Of Manual Operation

It is exceedingly difficult to depend on the human element in manually operating the feeding of a drill-press spindle on its reciprocating motion. Very often the results obtained will be erroneous due to the lack of uniformity in the speed and pressure of the spindle.



Mechanical Feeding

The line illustration above shows a regular standard type drill press on which a mechanical feeding device has been installed. This device consists of a motor-driven cam which causes the reciprocating motion of the spindle to operate at a constant speed and pressure. The spindle operates 9 strokes per minute at a speed of 6" per minute. There is sufficient time between strokes for the operator to change the drilling disc to a new drilling position. This also permits the operator to use both hands to manipulate the disc, which results in continuous drilling at the same rate of speed. This results in a more accurate test than would be possible if the operation was performed manually by starting at several intervals.

The life of the drill or the number of holes drilled before resharpening also depends on whether the holes that are being drilled are the through-type or blind.

Drilling Through-Type Holes

The through-type holes are most difficult to drill because of chipping possibility around the back of the hole. If

TEST TABLE	WITHOUT AIR BLAST							WITH AIR BLAST						
TEST	1			2			5	3			4			6
SPEED FT. PER MINUTE	138	138	138	75	75	75	256	138	138	138	75	75	75	256
DRILL ANGLE	118°	90°	60°	118°	90°	60°	118°	118°	90°	60°	118°	90°	60°	118°
THROUGH HOLES CHIPPED AT	52	58	83	56	59	102	3	54	60	96	68	72	202	13
BLIND HOLES DRILL READY FOR RESHARPENING	77	94	145	89	115	224	7	231	343	420	247	396	537	31

the hole is covered by a screw or a washer in the assembly, a slight chip is acceptable. However, when the hole is exposed, the chipped edge cannot be tolerated. Consequently, only 25% as many through holes can be produced as blind holes. This, of course, depends on various conditions as illustrated in the test table.

A general-purpose Durez phenolic material was selected for this test and was molded into a 4" diameter disc 5/16" thick. Regular stock 3/16" diameter steep-fluted high-speed drills (illustrated) were used. These drills were ground to the included angles of 118°, 90°, and 60°.

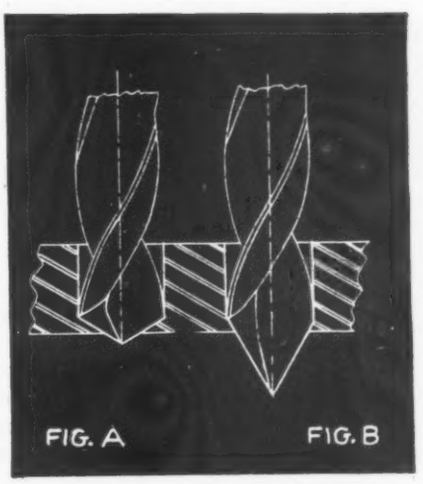
Chipping Tests

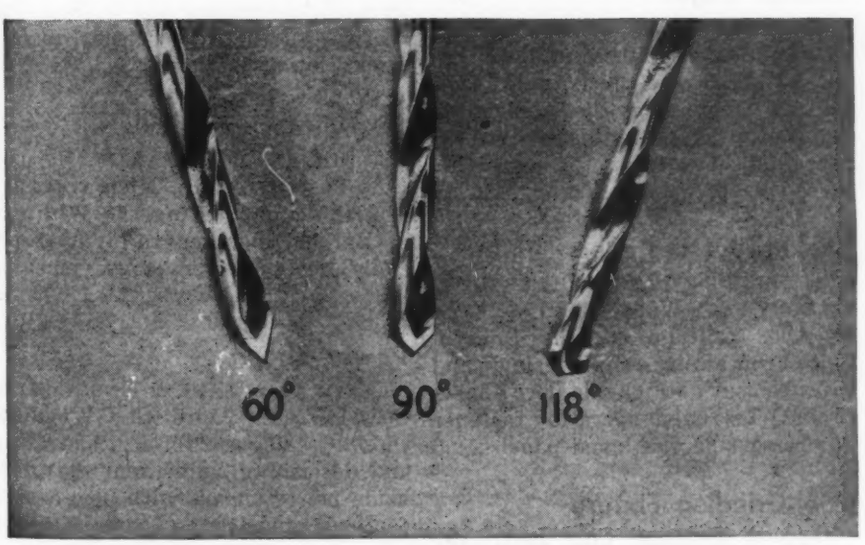
The results of the chipping tests are determined by .010" to .015" of chipping around the back of the hole at the conclusion of drilling. The number of blind holes drilled before the drill must be resharpened is determined by the dimensional wear. The holes must gage to —.001". Final check holes are illustrated in the photo of the center of test disc.

Color of the drill was also recorded. Test 1 all three drills—light yellow for approximately ½". Test 2 all three drills—light straw for approximately ½". Test 3 all three drills—light straw. Test 4—no change from original color. Test 5—burned blue. Test 6—burned blue. On test 4 the drills remained cool during the entire drilling test.

Air Blast An Advantage

A number of previous tests including mineral-filled-materials indicate that there is an increase of 200% to 300% in drilling production by the use of air blast concentrated on the drill in a position which will cause the air travel to terminate at the point of the drill.





Type of Drills Recommended

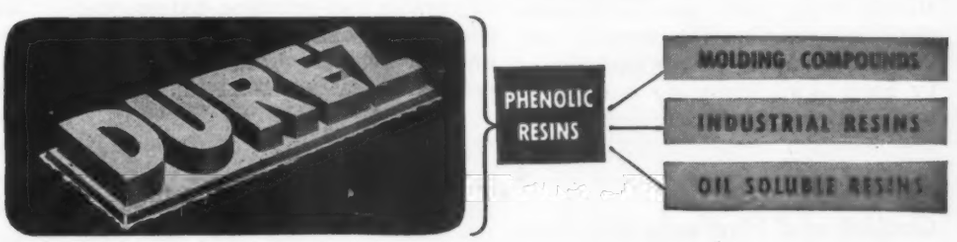
Drills ground to 60° included angle are definitely superior, especially when drilling the through-type holes. These drills increase the power requirements. However, the feeding pressure is reduced. This allows the drill to drill through with a minimum of chipping. The main factor of importance is the the remaining area of material at the conclusion of drilling a through hole. Fig. A illustrates a 118° drill and Fig. B 60°. Since Fig. A requires greater feeding pressure for drilling, and has greater area of remaining material, it will chip more readily than Fig. B.

Reducing the friction between the drill and the material by grinding the drill off center (which results in slightly larger hole) will often prolong the life of the drill. Friction causes the drill to overheat. This is particularly prevalent in phenolic materials because of their inability to dissipate heat. Consequently, all or most of the heat must be absorbed by the drill.

In some cases better results are obtained by plating the drills with hard chrome. Carbide tip drills are often used when drilling larger diameter holes and for large volume production, especially on materials which contain highly abrasive fillers.

Free Booklet

Write for free, authoritative booklet "Machining Data on Phenolic Plastics." You will find it most helpful because it covers all the standard phenolic plastic machining operations encountered in the average plant. No obligation, of course. Durez Plastics & Chemicals, Inc., 47 Walck Road, N. Tonawanda, N. Y.



PLASTICS THAT FIT THE JOB

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

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Precision Measuring and Gaging Equipment

COSA CORPORATION, 5000-4 Chrysler Bldg., New York 17, N. Y. Catalogue 738, descriptive of the Sip high-precision measuring machine for checking shop gages by direct measurement. Bulletin 818, illustrating and describing the Sip high-precision universal measuring apparatus for inspecting master and shop gages. Leaflet 851, announcing the new Sip profile projector AP-10 for precision gaging work. 1

Heat-Treatment Data

UNITED STATES STEEL CORPORATION SUBSIDIARIES, 429 Fourth Ave., Pittsburgh 19, Pa. 54-page publication entitled "Suiting the Heat-Treatment to the Job," containing technical data on the fundamentals of heat-treatment of value to designers, production men, and metallurgists. 2

Boring, Drilling, and Milling Machine Attachments

GIDDINGS & LEWIS MACHINE TOOL CO., 140 Doty St., Fond du Lac, Wis. Catalogue descriptive of accessories and attachments that increase production and lower machining costs on G. & L. horizontal boring, drilling, and milling machines. 3

Metal-Cutting Chart

L. S. STARRETT CO., Athol, Mass. Metal-cutting chart containing complete information for cutting any metal by hand or power hacksaw or by band saws, including number of teeth per inch and correct speeds and feeds for operating on different metals. 4

Coolant and Hydraulic Oil Data

BRIGGS FILTRATION CO., Bethesda 14, Md. Catalogue containing valuable information on the use of coolants in machining metals, and design and application data on coolant filters. Catalogue giving data of aid in the efficient operation of hydraulic systems. 5

Milling Machines

KEARNEY & TRECKER CORPORATION, Milwaukee 14, Wis. Catalogue CSM-20, illustrating and describing the new Kearney & Trecker CSM knee type milling machines especially designed to handle carbide milling operations. 6

Thread Gages

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass. Bulletin entitled "Use of the Open Angle Limit Check," describing the application and advantages of this method of checking the accuracy of inspection thread gages. 7

Shakeproof Fasteners

SHAKEPROOF, INC., DIVISION OF ILLINOIS TOOL WORKS, 2501 N. Keeler Ave., Chicago 39, Ill. Bulletin S-75, containing engineering and procurement data on the new Shakeproof Q-Two quick-operating fastener for removable or hinged panels.....8

Tool-Grinding Fixture

GEORGE SCHERR CO., INC., 199 Lafayette St., New York 12, N. Y. Circular descriptive of the Scherr adjustable tool-grinding fixture that enables the cutting angle and clearance of tools to be ground in one setting. 9

V-Belt Drives

MULTIPLE V-BELT DRIVE ASSOCIATION, 22 W. Monroe St., Chicago 3, Ill. Booklet entitled "How the Dominant Drive Speeds Production and Reduces Costs," describing the operating advantages of the multiple V-belt drive. 10

Heat-Resistant Protective Coatings

DAMPNEY CO. OF AMERICA, Hyde Park, Boston 36, Mass. Bulletin describing the characteristics and applications of "Thur-Ma-Lox" high-heat resistant coatings for metal surfaces. 11

Optical Inspection Dividing Head

VINCO CORPORATION, 8853 Schaefer Highway, Detroit 27, Mich. Bulletin 55, describing the outstanding features of the Vinco optical master inspection dividing head. 12

Screw Machine Drills

WHITMAN & BARNES, 2108 W. Fort St., Detroit 16, Mich. Circular describing and listing the Whitman & Barnes short-length drills especially designed for screw machine use. 13

Power Shears

CLEVELAND CRANE & ENGINEERING CO., 1157 E. 283rd St., Wickliffe, Ohio. Catalogue 2011-A, illustrating and describing "Steelweld" pivoted-blade power shears with new design features. 14

Safety Tools

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Catalogue 117, listing over 500 Ampco non-sparking safety tools for use in the presence of explosive liquids, fumes, gases, and dust. 15

Dust Collectors

AGET DETROIT CO., 602 First National Bldg., Ann Arbor, Mich. Catalogue A-350, containing data on

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Shot-Peening

PANGBORN CORPORATION, Hagerstown, Md. Booklet containing complete information on the use of shot-peening for increasing the fatigue life of metals, including performance data in the metal-working fields...17

Steel Treating Equipment

LAKESIDE STEEL IMPROVEMENT CO., 5418 Lakeside Ave., Cleveland 14, Ohio. Catalogue covering the company's line of flame-hardening, heat-treating, nitriding, and other steel treating equipment. 18

Tools for Precision High-Speed Milling

BROWN ENGINEERING CO., 1127 Riverside Drive, Los Angeles 31, Calif. Folder containing data on the Brown "All Universal" precision high-speed milling machine tool.....19

Hardsteel Drills

BLACK DRILL CO., 1400 E. 222nd St., Cleveland 17, Ohio. Catalogue covering the application of "Hardsteel" drills, including recommended speeds, drilling procedure, and other data of value to the user.....20

Design Data on Forgings

STEEL IMPROVEMENT & FORGE CO., Cleveland, Ohio. 36-page reference booklet, describing the equipment, tools, materials, and forging techniques used in forging metals in closed-impression dies. 21

Electric Controls

UNITED ELECTRIC CONTROLS CO., 69-71 A St., Boston 27, Mass. Catalogue containing complete information and engineering details on this company's line of thermostats and pressure switches. 22

Bearing-Race Tester

PHYSICISTS RESEARCH CO., Department 2, Ann Arbor, Mich. Circular 50, descriptive of an instrument for measuring bearing-race waviness and for the control of race-grinding machine set-ups. 23

Hyper-Drilling

REPUBLIC DRILL & TOOL CO., 322 S. Green St., Chicago 7, Ill. Bulletin J-2, descriptive of "Hyper-Drilling" with the new jet drill, designed to obtain speed and precision in mass production. 24

Ball Bearings for Precision Instruments

MINIATURE PRECISION BEARINGS, Keene, N. H. Catalogue containing engineering data on a line of miniature ball bearings for precision instruments. 25

Material-Handling Equipment

BOYER-CAMPBELL CO., 6540 St. Antoine St., Detroit 2, Mich. Circular describing the "Granny Grip," a cam-lever mechanism and chain for lifting heavily laden barrels, steel plate, etc. 26

Steel Tubing Specialties

SUMMERILL TUBING CO., Bridgeport, Montgomery County, Pa. Folder descriptive of a variety of special steel tubing products, including tubing as small as 0.004 inch inside diameter. 27

Industrial Gas Masks

MINE SAFETY APPLIANCES CO., Braddock, Thomas, and Meade Sts., Pittsburgh 8, Pa. Bulletin on industrial gas masks for protecting workers against gases, smoke, and dust. 28

Push-Broaches

EAST SHORE MACHINE PRODUCTS CO., 835 E. 140th St., Cleveland 10, Ohio. Bulletin 10, containing complete information on the Glenny adjustable-expansion keyway [illegible] broach. 29

Electrode-Holders

TWECO PRODUCTS CO., Wichita 7, Kan. Catalogue covering this company's line of welding accessories, including the new "Twecotong" manual arc-welding electrode-holders. 30

Oxy-Acetylene Machines

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Bulletin describing the Airco Camograph Nos. 4 and 5 oxy-acetylene cutting machines. 31

Plastic Products

GENERAL ELECTRIC CO., Plastics Divisions, 1 Plastics Ave., Pittsfield, Mass. Pamphlet entitled "One Plastics Avenue," describing the company's plastics facilities. 32

Electric Trucks

WRIGHT-HIBBARD INDUSTRIAL ELECTRIC TRUCK CO., INC., Phelps, N. Y. Catalogue 6, covering the Wright-Hibbard line of low- and high-lift platform and fork trucks. 33

Hydraulic Presses

WATSON-STILLMAN CO., Roselle, N. J. Bulletin 360-A, containing complete specifications on the new Watson-Stillman line of hydraulic hobbing and die-sinking presses with capacities of 200 to 3000 tons.....34

Direct-Reading Taper Gages

MOORE SPECIAL TOOL CO., INC., 740 Union Ave., Bridgeport 7, Conn. Circular illustrating and describing Moore direct-reading leaf taper gages for measuring hole sizes from 0.095 to 1.005 inches. 35

Foundry Grinding Wheels

NORTON CO., Worcester 6, Mass. Booklet 1405-IP, descriptive of the new Norton B-5 resinoid grinding wheels and other products for the foundry. 36

Fractional Horsepower Motors

JACK & HEINTZ PRECISION INDUSTRIES, INC., Cleveland 1, Ohio. Bulletin on the Jack & Heintz line of fractional-horsepower induction motors. 37

Depreciation

KEARNEY & TRECKER CORPORATION, Milwaukee 14, Wis. Pamphlet entitled "Depreciation vs. Obsolescence," dealing with this subject as applied to machine tools. 38

High-Conductivity Copper Castings

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 81, on high-conductivity copper castings made from Ampcoloy 90. 39

Flame-Hardening Apparatus

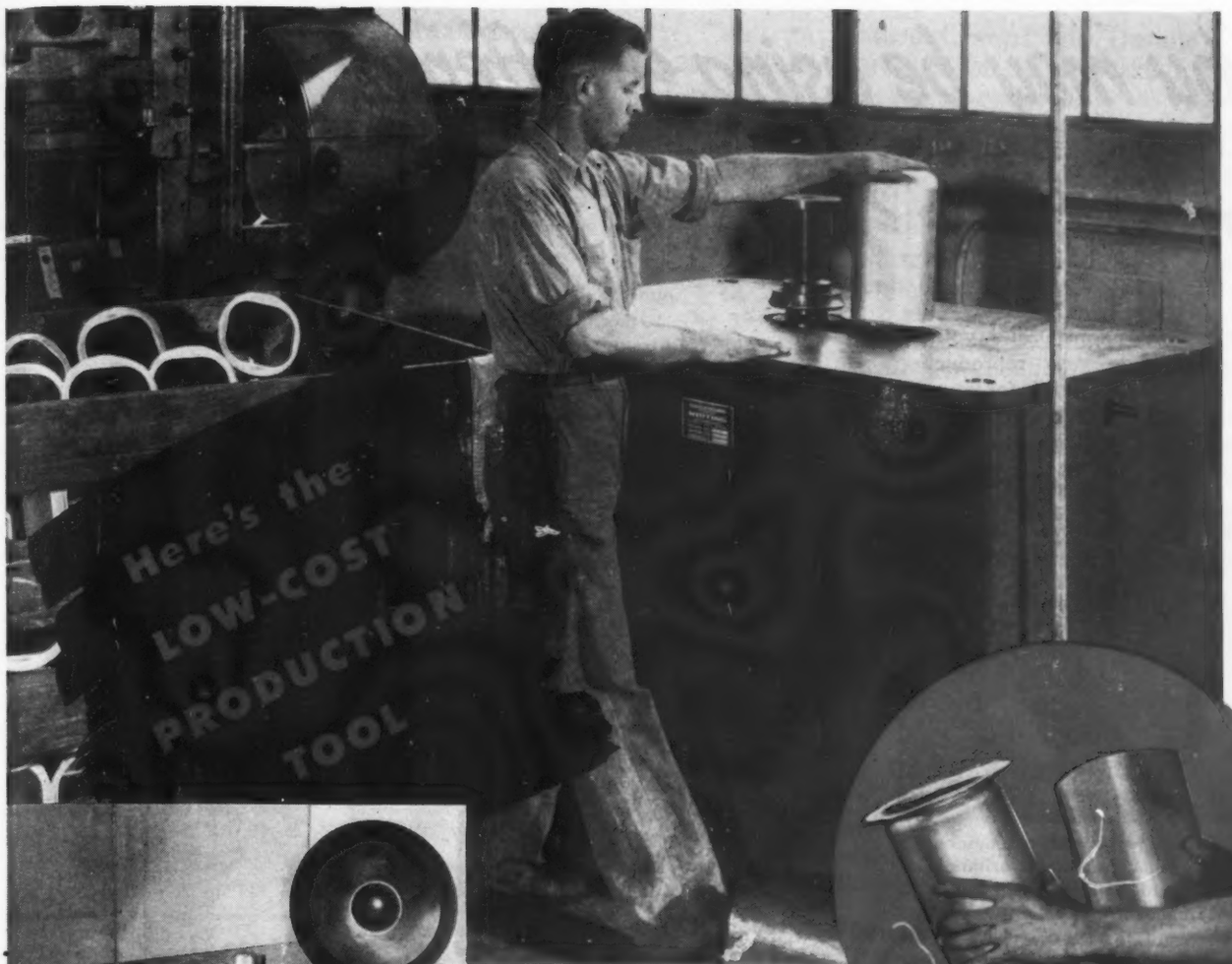
AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Catalogue 90, describing the design and use of Airco portable flame-hardening apparatus. 40

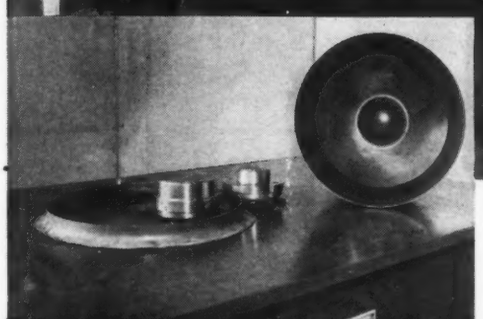
Photo-Elastic Stress Analysis

EASTMAN KODAK CO., Rochester 4, N. Y. Pamphlet entitled "Photo-Elastic Stress Analysis," outlining the theory, apparatus, photographic materials, etc. 41

Mill-Drill for Metal and Plastics

BARCO MACHINE PRODUCTS CO., 1975 E. 65th St., Cleveland 3, Ohio. Leaflet descriptive of the Barco Micro-King Mill-Drill for drilling holes in sheet metal and plastics...42





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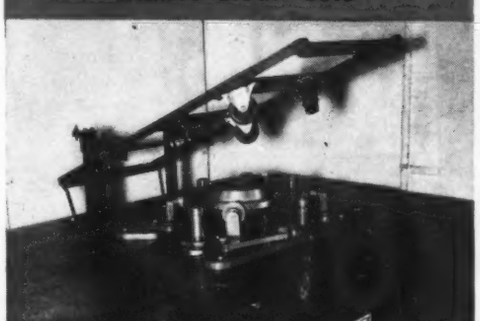

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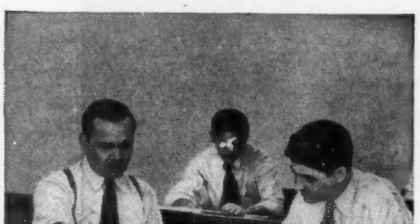

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Available now—Ozalid machines for large, medium, and occasional production requirements. Whichever model you choose, you have the *same* versatility.

See the 10 types of prints you can make with Ozalid . . . and learn all about this new graphic art everyone can use.
***Write today* for free booklet No. 85.**

OZALID

Division of
GENERAL ANILINE AND FILM CORPORATION
JOHNSON CITY, NEW YORK
Ozalid in Canada—Hughes Owens Co., Ltd., Montreal

Stub Screw Machine Drills

CHICAGO-LATROBE TWIST DRILL WORKS, 411 W. Ontario St., Chicago 10, Ill. Circular containing dimensional data and list prices on stub screw machine drills. 43

Blast Cleaning Equipment

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Catalogue 264, illustrating and describing the new 60- by 96-inch "Wheelabrator Tumblast." 44

Meehanite Castings

MEEHANITE RESEARCH INSTITUTE, Pershing Square Bldg., New Rochelle, N. Y. Bulletin entitled "Meehanite Quality Control Assures Uniform Dependability." 45

Screw-Thread Inserts

AIRCRAFT SCREW PRODUCTS CO., INC., 47-23 Thirty-fifth St., Long Island City 1, N. Y. Bulletin 300, entitled, "Heli-Coil System for Replacing Stripped Threads." 46

Tool-Holders

BOKUM TOOL CO., 14775 Wildemere Ave., Detroit 21, Mich. Circular 464, descriptive of a new tool-holder with vertical adjustment for holding boring tools in lathes. 47

Portable Spot-Welders

TWEEZER-WELD CORPORATION, 280 Plane St., Newark 2, N. J. Circular illustrating and describing the Besco Tweezer portable spot-welding machine for small parts. 48

Steel-Plate Rings

LUKENS STEEL CO., 282 Lukens Bldg., Coatesville, Pa. Circular 282, describing the company's facilities for making steel-plate rings of any size or type. 49

Micro-Switches in Gaging Devices

MICRO SWITCH, Freeport, Ill. Bulletin 36, dealing with the use of Micro Switch products in sorting and gaging devices. 50

Pyrometer Supplies

BROWN INSTRUMENT CO., DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO., Philadelphia 44, Pa. Buyers' Guide on standard pyrometer supplies. 51

Clamps and Pliers

KNU-VISE, INC., 2200 Eighth St., Detroit 16, Mich. Catalogue 44, covering this company's entire line of toggle-action clamps, pliers, and wrenches. 52

Pneumatic Tools

KELLER TOOL CO., Grand Haven, Mich. Catalogue 12, containing data on the company's complete line of pneumatic tools and their applications. 53

Pictorial Engineering Drafting

JOHN R. CASSELL CO., INC., 110 W. 42nd St., New York 18, N. Y. Booklet entitled "Axonometric Drawing—the Universal Picture Language." 54

Fixture Clamps and Details

MORTON MACHINE WORKS, 2421 Wolcott St., Ferndale 20, Mich. Catalogue and price list covering Morton fixture details and fixture clamps. 55

Retaining Rings

WALDES KOHINOOR, INC., Long Island City 1, N. Y. Catalogue 4, containing technical information on basic "Truarc" retaining ring types, including application data. 56

Gages

NILSSON GAGE CO., INC., 2-A Lake St., Poughkeepsie, N. Y. Catalogue covering the general line of Nilsson gages, including price list and information helpful to buyers. 57

Corrosion Control

DOW CHEMICAL CO., Midland, Mich. Booklet dealing with the use of magnesium anodes for cathodic protection in corrosion control. 58

Air Control Valves

VALVAIR CORPORATION, 454 Morgan Ave., Akron 11, Ohio. General catalogue covering this company's line of air control valves. 59

Planers

LIBERTY PLANERS, INC., Hamilton, Ohio. Catalogue 157, covering the Liberty line of double-housing, convertible, and open-side planers.....60

Mobile Machine Shop

DAVEY COMPRESSOR CO., Kent, Ohio. Booklet describing the Davey

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To Obtain Copies of New Trade Literature

listed on pages 230-236 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name.....*Position or Title*.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm .....

Business Address.....

City .....*State* .....

[SEE OTHER SIDE]

"mobile machine shop," for making immediate repairs in the field.....61

Slide-Rules and Scales

CHARLES BRUNING CO., INC., 4754 Montrose Ave., Chicago 41, Ill. Circular descriptive of Bruning pocket slide-rules and scales. 62

Hand Trucks

MASSEY MACHINE CO., 800 Pearl St., Watertown, N. Y. Bulletin HT-46, announcing the new Massey line of hand trucks. 63

Capacitor Motors

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Circular GEA-4443, on G-E capacitor motors for jet-pump drives. 64

Pipe Tools

BEAVER PIPE TOOLS, INC., Warren, Ohio. Condensed catalogue covering the Beaver line of pipe and bolt machinery and tools. 65

Coated Abrasives

CLOVER MFG. CO., Norwalk, Conn. Catalogue on Clover coated abrasives, including technical data. 66

Control Valves

C. B. HUNT & SON, INC., Salem, Ohio. Bulletin 107, on "Quick-As-Wink" control valves. 67

Rail-Cropping Machines

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Circular on Airco portable rail-cropping machine for railroad maintenance work. 68

New Permanent-Magnet Materials Announced by General Electric Co.

Five new permanent-magnet materials, known as Cunico, Cunife, Vectolite, Alnico 12, and Silmanal, have been announced by the General Electric Co., Schenectady, N. Y. These new materials have many applications in the manufacture of aircraft instruments, as well as other industrial uses where small, lightweight magnets formed in intricate shapes are required.

Cunico is an alloy of copper, nickel, and cobalt. Cunico magnets are made from rod, strip, or wire stock, and are furnished only in their final shapes, as they are age-hardened in the manufacturing process. Cunico is malleable, ductile, and machinable, permitting the manufacture of small magnet screws from this material by ordinary screw machine methods and the punching of intricate magnet shapes.

Cunife is a copper-nickel-iron alloy which has all the physical properties of Cunico, but differs in that it has directional properties and must be magnetized only along the direction in which the material has been cold-worked to obtain highest magnetic quality. Cunife magnets are made from wire stock in round, square, or rectangular form. In addition, Cunife wire can be flattened to form thin, narrow shapes. A wide variety of magnet designs can be obtained by forming, drawing, punching, or machining Cunife to shape.

Vectolite is the first non-metallic, non-conducting magnet material ever made. It is a hardened, sintered combination of iron rust and cobalt oxide, mixed while still in powder form. Vectolite magnets are extremely light, being non-metallic, and their non-conductive properties prevent electrical losses caused by conduction of current. In addition, they have a high coercive force, or resistance to demagnetizing forces.

Alnico 12 is made up of aluminum, nickel, cobalt, iron, and titanium. Magnets made from this material can be used in such applications as tachometer generators and electronic devices. Alnico 12 magnets are cast, and must be ground to shape.

Silmanal has a high intrinsic coercive force, which makes magnets made from this material useful in instruments where service in strong electrical fields is required. Silmanal is ductile and malleable, and can be punched, machined, rolled, or ground. Because of its ductility, Silmanal can be made in rod, strip or wire form.

* * *

The total number of electrical measuring instruments produced at the Newark, N. J., Meter Works of the Westinghouse Electric Corporation for use by the armed forces in World War II was 3,239,547—enough to have provided each soldier of General George Washington's Continental Army with thirteen, if he could or would have carried them.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 201-224 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in July, 1946, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 196-197, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in July, 1946, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

[SEE OTHER SIDE]

One of the most important reasons why Cone-Drive gearing can carry *more load* and transmit it more *smoothly,* is the equipment used to produce it. Developed by Michigan Tool Company, Cone-Drive generators are themselves operated through Cone-Drives.

These gear generators, with their greater precision, made possible by Cone-Drive gearing —insure that the inherent advantages of Cone-Drives (greater load capacity per tooth, greater number of teeth in contact, more positive lubrication, longer life, greater quietness, greater compactness, etc.) are machined into every Cone-Drive produced.

Shown here is a Cone-Drive driven Cone-Drive No. 1018 gear generator, designed for producing Standard (carried in stock) and special gear sets from 3″ up to 18″ C. D. and with ratios ranging from 2:1 to 200:1. Such Cone-Drives can transmit as much as 710,000 in. lbs. of torque at 100 r. p. m. of pinion (for a 20:1 ratio, 18″ center distance gear set).

For information on standard sizes and ratios of Cone-Drives —now carried in stock—write for Bulletin No. 700.

CONE-DRIVE DIVISION **MICHIGAN TOOL COMPANY**
7171 E. McNichols Road, Detroit 12, U.S.A.

News of the Industry

California and Oregon

WENDT-SONIS Co., Hannibal, Mo., has opened a new plant for the manufacture of carbide cutting tools at 580 N. Prairie Ave., Hawthorne, Calif. The Hawthorne plant will be under the direction of B. E. ROBINETT, western district manager of the company. ALBERT WHEAR will be plant superintendent.

CHARLES E. KLAUS has been appointed representative in the Portland, Ore., area for the ALLEN-BRADLEY Co. Mr. Klaus will take over the territory formerly served by GARLAND-AFFOLTER ENGINEERING CORPORATION. His office is at 1233 N.W. Twelfth Ave., Portland, Ore.

District of Columbia and Virginia

R. N. LANDRETH, assistant to the vice-president, General Machinery Division, of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has been placed in charge of the company's Washington, D. C., district office, which he will handle in addition to his other special duties. He takes the place in Washington of RALPH R. NEWQUIST, who has resigned.

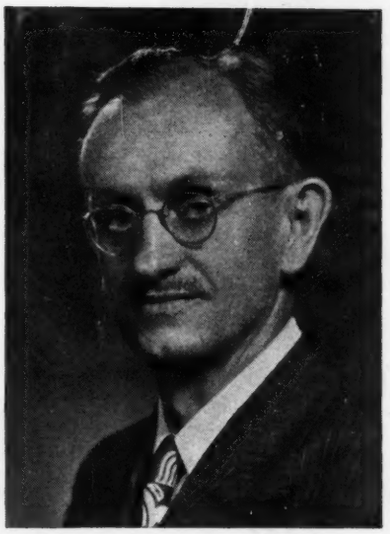
CARBOLOY COMPANY, Detroit, Mich., has appointed the INDUSTRIAL SUPPLY CORPORATION, 15th and Franklin Sts., Richmond 15, Va., distributor of cemented-carbide tools in the central and western portion of Virginia.

Illinois

LINK-BELT Co., Chicago, Ill., manufacturer of materials-handling and mechanical power transmission machinery, has opened three new sales offices at 1608 Fifth Ave., Moline, Ill.; 730 Temple Bar Bldg., Main and Court Sts., Cincinnati 2, Ohio; and 823 Comer Bldg., 2100 Second Ave., N., Birmingham 3, Ala. M. J. PARYKAZA is district sales engineer at Moline, L. R. CLARK at Cincinnati, and C. C. WILEY at Birmingham.

GEORGE P. TORRENCE rejoined the Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill., in the capacity of executive vice-president on July 1, and will become president of the company on November 1, 1946, succeeding WILLIAM C. CARTER who will retire at that time, in accordance with the company's retirement plan. Mr. Torrence resigned the position of president of the Link-Belt Co. in 1936.

HOWARD F. MACMILLIN has been elected vice-president of the Bryant Machinery & Engineering Co., Chicago 6, Ill. Mr. MacMillin is a leader in the engineering development and manufacture of hydraulic presses and other production machinery, having previously served as president and general manager of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Prior to his present appointment, he was affiliated with Arthur D. Little, Inc., a research organization of Cambridge, Mass., with whom he will continue to have a connection.



Howard F. MacMillin, New Vice-president of the Bryant Machinery & Engineering Co.

OLIVER MAISCH & Co., 168 N. Ogden Ave., Chicago 7, Ill., engineers and manufacturers of precision tools, announce that in the future the business of the company will be conducted under the name of the MECHANICAL PRODUCTS CORPORATION. The management will continue the same, with the addition of CARL HARRIS to the executive staff in the capacity of vice-president and works manager.

IRVING A. HECHT, formerly general sales manager for Willey's Carbide Tool Co., Detroit, Mich., has established a firm known as IRVING A. HECHT & ASSOCIATES, with offices at 30 N. LaSalle St., Chicago 2, Ill. The company will specialize in the cutting tool engineering field as consultant and manufacturers' representative.

HAROLD L. GEIGER, head of the Chicago Technical Section of the Development and Research Division of the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y., has been elected chairman of the Chicago Chapter of the American Society for Metals for the year beginning September, 1946. Last year he served as vice-chairman of the Chicago Chapter.

ONSRUD CUTTER MFG. Co. has been organized at Libertyville, Ill., to engage in the production of all types of cutters for shaping, routing, and related operations. The new firm will supply all the requirements of the Onsrud Machine Works, as well as serving the needs of other customers.

LEW C. DAVIES has been appointed exclusive representative in the Chicago territory for the ACME MACHINERY DIVISION OF THE HILL ACME Co., 6400 Breakwater Ave., Cleveland 2, Ohio, manufacturer of forging machines. Mr. Davies' office is located at 332 S. Michigan Ave., Chicago, Ill.

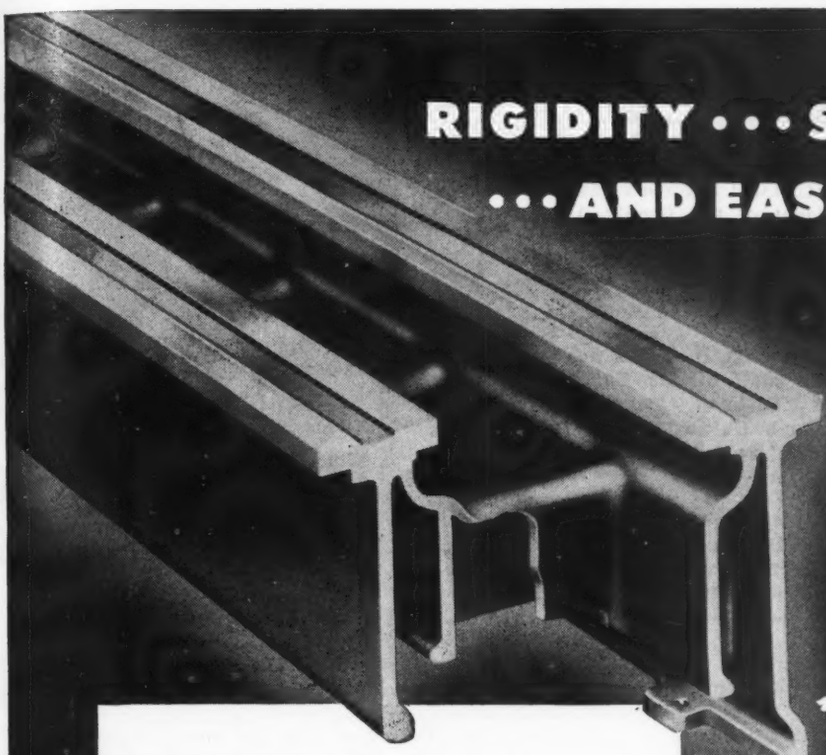
FRY LAWSON & Co., 135 S. La Salle St., Chicago 3, Ill., announce that their business as consulting management engineers has been incorporated under the name of GEORGE FRY & ASSOCIATES, INC.

C. C. BROOKS, western manager of the Hoisting Machinery Division of Robins Conveyors, Inc., Passaic, N. J., manufacturers of materials-handling machinery, has retired. Mr. Brooks' headquarters were in Chicago.

Michigan and Wisconsin

JOHN O. ALMEN, of the General Motors Research Laboratories, Detroit, Mich., was presented with the Edward P. Connell Award by the American Gear Manufacturers Association at the thirtieth annual dinner of the Association held June 4 at the Homestead, Hot Springs, Va. This award was established by the

John O. Almen, Recipient of the Edward P. Connell Award of the A.G.M.A.



RIGIDITY · · · SMOOTH POWER · · · AND EASE OF CONTROL

Sidney has all three

You will find the three essentials to precision lathe production in Sidney Lathes.

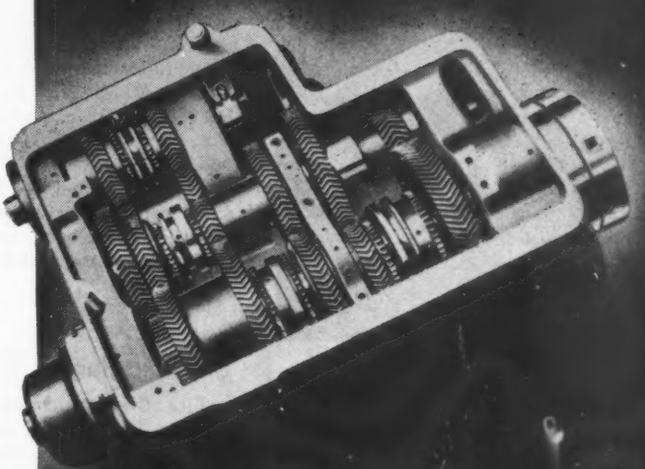
RIGIDITY that stems from a four wall bed construction amply cross girted at frequent intervals. This design departs from conventional two wall construction and gives a better distribution of metal providing greater resistance to deflections and twisting strains.

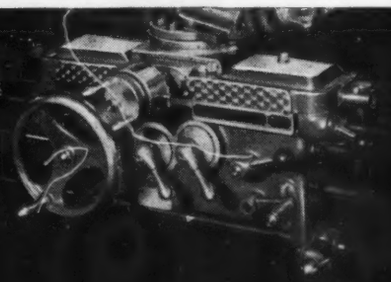
SMOOTH POWER is assured through the continuous tooth herringbone geared headstock. This form of tooth provides more tooth contact resulting in greater strength, smoother action and elimination of end thrust through the opposed helix angle. In addition to conventional bearings both spindle and intermediate shaft are supported by center bearings.

EASY OF CONTROL is provided in centralization of all control levers. The control for both longitudinal and cross feed is through independent snap levers on the apron which actuate jaw clutches and is provided with an overload safety feature. An interlock prevents the use of the feed gearing when half nuts are engaged.

Thus Sidney Lathes give you rigidity that assures continued accuracy—smooth power to handle heavy cuts and maintain high finish—and ease of control that assures more work with less effort on the part of the operator.

Bulletins on all sizes available.





Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

ESTABLISHED 1904

Falk Corporation in memory of the late Edward P. Connell, vice-president of that organization. The American Gear Manufacturers Association designates the recipient of the award. Mr. Almen is a pioneer in the development of extreme-pressure lubricants, and has designed several machines used for testing lubricants and engine bearings. He has also devoted much attention to problems of the strength of materials.

CARBOLOY COMPANY, INC., Detroit, Mich., announces the appointment of the following distributors: PROVIDENCE MILL SUPPLY CO., 389 Charles St., Providence, R. I.; BRIERLY, LOMBARD & CO., INC., 107 Foster St., Worcester 8, Mass.; and C. W. MARWEDEL, 1235 Mission St., San Francisco 3, Calif.

WALTER F. CAHILL has been elected a member of the board of directors of Lincoln Park Industries, Lincoln Park, Mich. Mr. Cahill is head of the Walter

Walter F. Cahill, Newly Elected Director of Lincoln Park Industries

F. Cahill Co., manufacturers' representatives, who handle the sales of Lincoln Park products in Michigan. Prior to organizing his own company in 1942, he was sales engineer in the Detroit area for the National Automatic Tool Co.

FRANK O. JAPPEL has been appointed sales manager of the Eclipse Counterbore Co., Detroit, Mich. He has been associated with the sales department of the company for the last eleven years, handling the western Detroit and lower Michigan territory.

H. A. ROEMER, JR., has been elected president of the Detroit Seamless Steel Tubes Co., Detroit 8, Mich., and J. H. DUNBAR has been elected chairman of the board. Mr. Roemer, who has been executive vice-president, succeeds Mr. Dunbar in the presidency.

E. W. SCHOEN has been appointed metallurgical engineer for the Bellevue Industrial Furnace Co., 2971 Bellevue Ave., Detroit 7, Mich. R. B. HAMMOND has been made general manager, secretary, and treasurer of the company.

MALCOLM P. FERGUSON has been elected president of the Bendix Aviation Corporation, Detroit, Mich., to succeed ERNEST R. BREECH, who has resigned to become executive vice-president and a director of the Ford Motor Co.

MAJOR CARL R. TUFTS has joined the Detroit staff of the Baker Industrial Truck Division, Baker-Raulang Co., Cleveland, Ohio. Major Tufts was recently released from active duty in the armed forces.

CHARLES HARRISON has been appointed division manager in the western Michigan territory for the Aro Equipment Corporation, Bryan, Ohio. His headquarters will be at Lansing, Mich.

EDLUND TOOL CO. announces that, in future, the firm will be known as the EDLUND CO., and will be located in new and larger quarters at 11666 Cloverdale, Detroit 4, Mich.

SIMPLEX MACHINE TOOL DIVISION OF STOKERUNIT CORPORATION, Milwaukee 14, Wis., manufacturer of precision boring machines, planer type milling machines, and special machine tools, has appointed the following sales representatives: GEORGE D. MILLER CO., Rockefeller Bldg., Cleveland, Ohio, and STATE MACHINERY CO., INC., 31 E. Georgia St., Indianapolis, Ind. For the last twelve years the George D. Miller Co. has been exclusive sales representative of the company in the Cleveland area, and its territory is now being expanded to include the Toledo area.

New England

THE GEOMETRIC TOOL COMPANY, New Haven 15, Conn., has appointed the BROWNING TOOL & SUPPLY CO., 316 E. Wayne St., Fort Wayne 2, Ind., and the FORT WAYNE PIPE & SUPPLY CO., 101-103 E. Columbia St., Fort Wayne 2, Ind., distributors for the company.

GORDON E. BROWN has been transferred from the main office at Milwaukee, Wis., of Ampco Metals, Inc., to the Hartford, Conn., district as field engineer.

H. LEACH MACHINERY CO., 387 Charles St., Providence 4, R. I., has been appointed national distributor in the United States for the line of milling machines and attachments made by the FRAY MACHINE TOOL CO., Glendale, Calif.

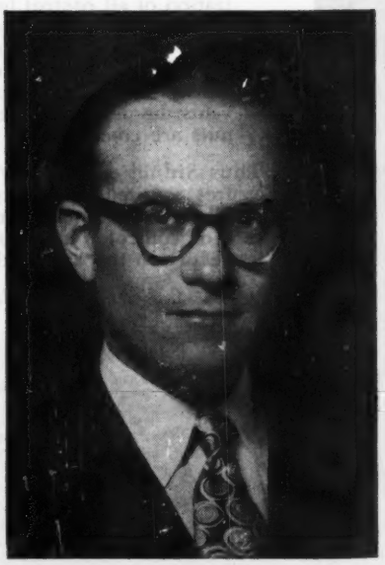
GEORGE P. LEHMANN has been appointed assistant manager of the Plastics Divisions of the General Electric Co., 1 Plastics Ave., Pittsfield, Mass. He was a colonel in the Twelfth Air Force Service Command, and has been staff assistant to the manager of the Plastics

George P. Lehmann, Assistant Manager, Plastics Divisions, General Electric Co.

Divisions since his return from service last fall. DAVID FITZGERALD has been named manager of employe relations.

New York and New Jersey

DR. R. M. REICHL has been promoted to the position of vice-president of Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y. Dr. Reichl has had wide experience in the design, construction, and operation of hydraulic presses and rolling mills. He served as consulting engineer on many of the company's developments for the Army, Navy, and Air Forces. Dr. Reichl obtained his degree as Doctor of Science at the University of Prague in 1929.

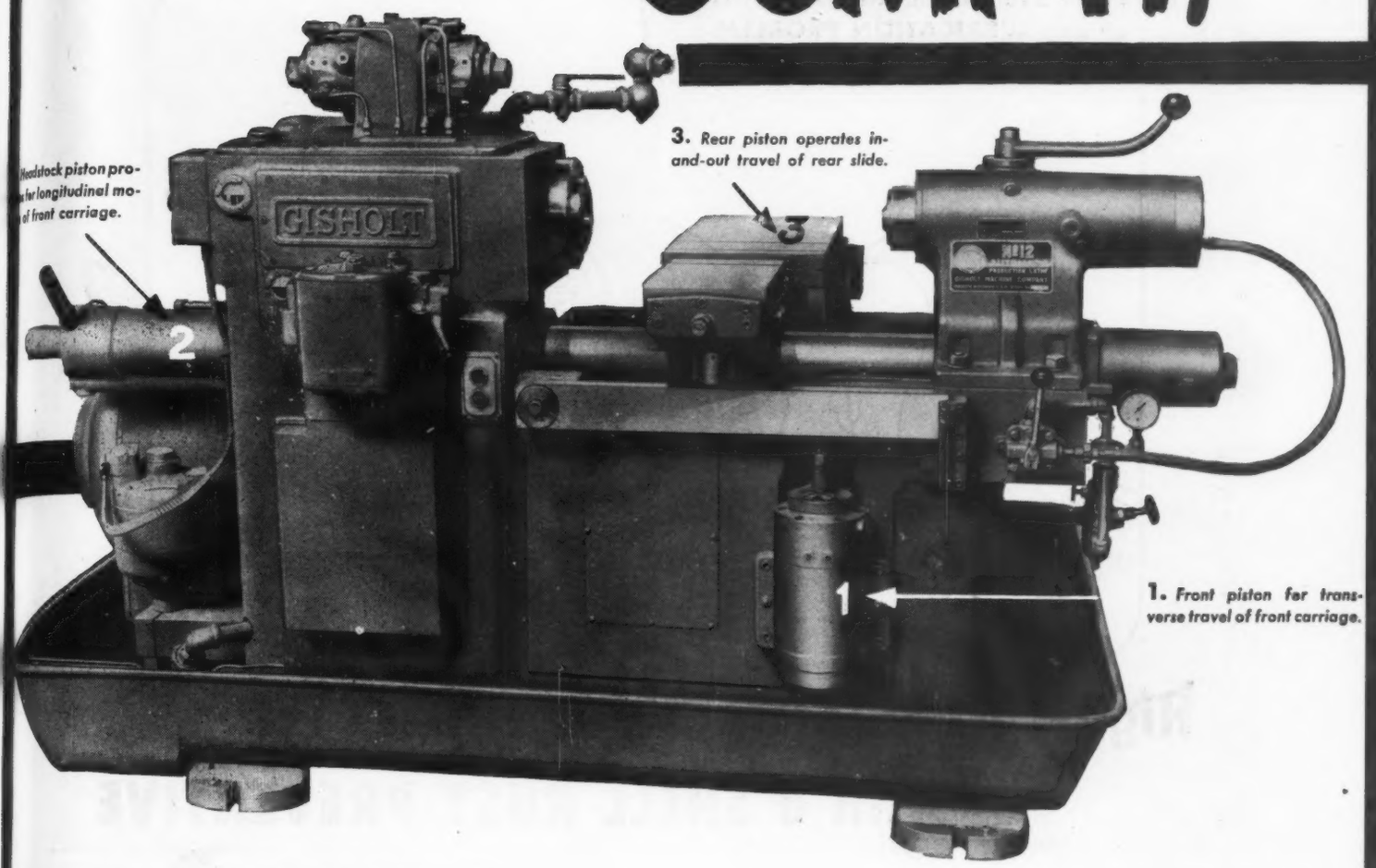


Dr. R. M. Reichl, who has been made Vice-president of Hydropress, Inc.

operating cycle

with

"OOMPH!"



THE GISHOLT HYDRAULIC AUTOMATIC LATHE

You'll admire the way this husky little lathe goes about its business. Completely automatic, the operator has only to chuck the piece and touch the control valve handle. All tool travel—including rapid approach, feed during cut, tool fade-out, and rapid retract at the end of the cycle—is by hydraulic pressure. Three hydraulic cylinder units, as indicated above, actuate all tool movements.

The front piston elevates the guide bar, advancing front carriage tools transversely to cutting position. The headstock piston moves the front carriage longitudinally to complete the turning—after which tools fade away, both cross and lengthwise, by controlled, hydraulic relief.

Simultaneously, the rear slide piston advances tools rapidly and feeds them through the cut. Tools for both carriages are rapidly returned to starting position as soon as the rear slide has completed its work. At this point the driving clutch is disengaged and the spindle brake applied. The total machining time for the piece is the time of the longest cut.

This genuinely rugged automatic lathe performs equally well on arbor or between-centers work, chucking jobs, or work held in special fixtures. Write for complete details.

•

GISHOLT

GISHOLT MACHINE COMPANY

1209 E. Washington Ave. • Madison 3, Wis.

Look Ahead..Keep Ahead..with Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

High-Carbon Strip Steel PROTECTED with a SHELL RUST PREVENTIVE

PROBLEM: Lubricant used in machines perforating high-carbon safety razor steel had to be removed before etching. "Batch" production made storage of clean coils necessary. This manufacturer of razor blades sought a rust preventive that would protect coils during storage period, but which could be easily washed off just before etching.

SOLUTION: When the Shell Lubrication Engineer surveyed the problem, he recommended a Shell Ensis product, a rust preventive that can be applied by dipping at room temperature and which washes off in cold water. The manufacturer was delighted, especially when Ensis-coated coils showed no ill effects after being stored in an area contaminated with acid fumes.

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for a copy of Shell's 40-page booklet on Rust Preventives. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL RUST PREVENTIVES

OILS . . . FLUIDS . . . COMPOUNDS

SHELL

SYNCHRONOUS MOTOR "TROUBLE-SHOOTING" CHART—1

Trouble	Cause	Remedy
Motor will not start	Faulty connection	Inspect for open or poor connection.
	Open circuit, one phase	Test, locate, and repair.
	Short circuit, one phase	Open and repair.
	Voltage falls too low	Reduce the impedance of the external circuit.
	Friction high	Make sure bearings are properly lubricated.
		Check bearing tightness.
		Check belt tension.
		Check load friction.
		Check alignment.
	Field excited	Be sure field-applying contactor is open and field-discharge contactor is closed through discharge resistance.
	Load too great	Remove part of load.
	Automatic field relay not working	Check power supply to solenoid.
		Check contactor tips.
		Check connections.
	Wrong direction of rotation	Reverse any two main leads.
Motor will not come up to speed	Excessive load	Decrease the load.
		Check operation of unloading device (if any) on driven machine.
	Low voltage	Increase voltage.
	Field excited	Be sure field-applying contactor is open, and field-discharge contactor is closed through discharge resistance.

MACHINERY'S Data Sheet No. 565, July, 1946

Compiled by the General Electric Co. Schenectady, N. Y.

SYNCHRONOUS MOTOR "TROUBLE-SHOOTING" CHART—2

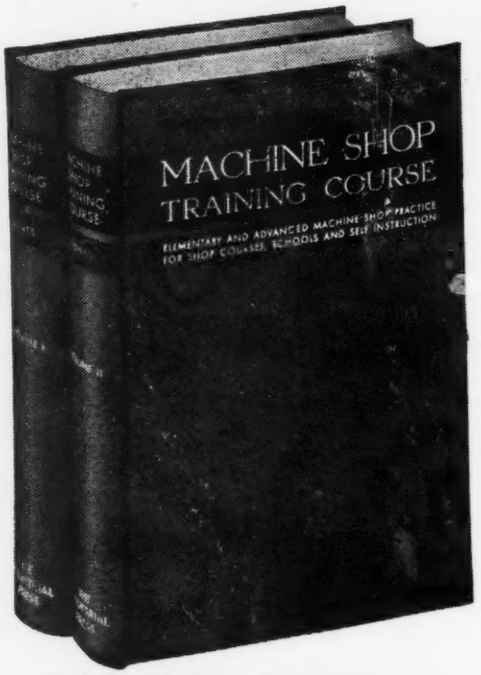
Trouble	Cause	Remedy
Motor fails to pull into step	No field excitation	Check circuit connections. Be sure field-applying contactor is operating.
		Check for open circuit in field or exciter.
		Check exciter output.
		Check rheostat.
		Set rheostat to give rated field current when field is applied.
		Check contacts of switches.
	Load excessive	Reduce load.
		Check operation of unloading device (if any) on driven machine.
	Inertia of load excessive	May be a misapplication—consult manufacturer.
Motor pulls out of step or trips breaker	Exciter voltage low	Increase excitation.
		Examine exciter. Check field ammeter and its shunt, to be sure reading is not higher than actual current.
	Open circuit in field and exciter circuit	Test with magneto, and repair break.
	Short circuit in field	Check with low-voltage and polarity indicator, and repair field.
	Reversed field spool	Check with low-voltage and polarity indicator, and reverse incorrect leads.
	Excessive torque peak	Check driven machine for bad adjustment or consult motor manufacturer.
	Failure of power	Re-establish power circuit.
	Line voltage too low	Increase if possible. Raise excitation.

MACHINERY'S Data Sheet No. 566, July, 1946

Compiled by the General Electric Co. Schenectady, N. Y.

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS



Price $6 Set—Payable $2 with Order, $2 Monthly

This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains over 1100 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Gear Design Simplified

Size 8-1/2 x 11 Inches

This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm-gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price $3 copy.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

PROFESSOR J. N. GOODIER has been presented with the Westinghouse award for notable contributions in engineering teaching. The award, recently established by the Westinghouse Electric Corporation, consists of $1000 and is accompanied by a special certificate. Professor Goodier is professor of machine design and head of the department of machine design and the department of mechanics at Cornell University, Ithaca, N. Y.

HARRY COSTELLO has recently become associated with Advance Pressure Castings, Inc., 894 Manhattan Ave., Brooklyn 22, N. Y. Mr. Costello will have charge of the Estimating Division and the Planning Board of the Selectively Processed Division of the company.

A. P. HALL has been elected vice-president of the American Chain & Cable Co., Inc., Bridgeport 2, Conn. He will also continue his present duties as general manager of sales, with headquarters at 230 Park Ave., New York City.

W. B. HERBERT has been made vice-president and general manager of Cinrock Machinery, Inc., New York City. He has been with the company since its inception about three years ago.

WILLARD W. BOESWETTER, CARROLL A. PICKERING, and EUGENE B. HAUSER have joined the field and service force of the Hanson-Van Winkle-Munning Co., Matawan, N. J.

Ohio

HERBERT T. FLORENCE has been elected president and general manager of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. He has been general manager since 1938 and vice-president since 1941. A. C. GARNETT, formerly secretary and treasurer, becomes vice-president and treasurer. W. G. WEHR has been made secretary.

FREDERICK V. GEIER, president of the Cincinnati Milling Machine Co., Cincinnati, Ohio, and TELL BERNA, general manager of the National Machine Tool Builders' Association, recently broadcast over station WLW, Cincinnati, a discussion of the relationship between machine tools and the prices of such products as automobiles, refrigerators, vacuum cleaners, and radios. This program is the first of a series of three designed to inform the public concerning the basic economics of machines, prices, and jobs. Among the speakers scheduled for subsequent programs are WILLIAM P. KIRK, president of the National Machine Tool Builders' Association and vice-president of Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn.; RICHARD E. LEBLOND, president of the R. K. LeBlond Machine Tool Co., Cincinnati, and LOUIS POLK, president of the Sheffield Corporation, Dayton, Ohio.

ROBERT H. DAVIES, formerly manager of Technical Service for the Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio, has been appointed head of a new engineering division of the company, which will combine the functions of product development, product engineering, and technical service. LELAND H. SCHMOHL, who has been connected with the company for sixteen years, will continue to direct product development in the new engineering division as chief design engineer.

BYRON C. FOY, formerly vice-president of Chrysler Corporation, Detroit, Mich., is now chairman of the board of Jack & Heintz Precision Industries, Inc., Cleveland, Ohio. WILLIAM S. JACK is president of the company, which was formed in March of this year through a merger of JACK & HEINTZ, INC., with PRECISION PRODUCTS CORPORATION.

Byron C. Foy, Chairman of the Board of Jack & Heintz Precision Industries, Inc.

TIMKEN ROLLER BEARING CO., Canton, Ohio, announces the return of the following men to the Industrial Division: R. G. HARMON, D. G. GIBSON, R. L. WILLIAMS, F. J. HARTSHORNE, and L. M. MEYER, field engineers at Chicago, Cincinnati, Cleveland, Milwaukee and Pittsburgh, respectively; S. T. SALVAGE, assistant district manager, Cleveland; and L. H. GEGENHEIMER, district manager in Boston.

CLINTON G. THOMAS, founder of the Thomas Steel Co., Warren, Ohio, has retired from all business activities, including his duties as a director and chairman of the board. CHARLES H. LEWIS has been elected chairman of the board; E. MILTON BARBER, president; WILLIAM F. RUMMELL, vice-president in charge of sales; and HERMAN A. MENTALL, vice-president in charge of operations.

D. & S. MODEL CO., 3114-30 E. 3rd St., Dayton 3, Ohio, has acquired rights to the manufacture and sale of the Rieger line of small tools, comprising the Multifacer, circle cutter, spindle stop, and die-holder.

CHESTER MFG. CO., Lisbon, Ohio, manufacturer of chain hoists, trolleys, etc., has been incorporated as the CHESTER HOIST CO.

COPPERWELD STEEL CO., Warren, Ohio, has appointed J. L. STONE New York district sales manager and HARRY GAFKE Chicago district sales manager.

DENISON ENGINEERING CO., Dublin Road, Columbus 16, Ohio, manufacturer of

Herbert T. Florence, Newly Elected President of Cleveland Crane & Engineering Co.

A. C. Garnett, Who Becomes Vice-president of Cleveland Crane & Engineering Co.

hydraulic presses, has appointed the following distributors: BRYANT MACHINERY & ENGINEERING CO., 400 W. Madison St., Chicago 6, Ill., and WILLIAM K. STAMETS CO., Jenkins Arcade Bldg., Pittsburgh 22, Pa.

DAVID M. HALLIER has been appointed sales manager of the National Tool Co., Cleveland, Ohio. He was previously assistant sales manager of the company.

GUY M. STONE has been made manager of the Coshocton, Ohio, plant of the General Electric Plastics Divisions.

Pennsylvania

L. E. VAIL has been designated sales representative in the northern Ohio district for the Titan Metal Mfg. Co., Bellefonte, Pa., manufacturer of brass and bronze rods, forgings, die-castings, and welding rods. Mr. Vail's headquarters are at 408 Carnegie Hall Bldg., Cleveland, Ohio. J. A. GULICK has been appointed sales representative for Oklahoma, Arkansas, and northwestern Texas, with offices at 310 Thompson Bldg., Tulsa, Okla.

C. V. GREGORY has been appointed Pittsburgh district manager for the Reliance Electric & Engineering Co., Cleveland, Ohio, succeeding BON J. BALLARD, who becomes assistant to the sales vice-president. L. J. CARR, who has recently been released from service in the United States Naval Reserve and prior to that was a sales engineer in the Chicago office of the company, will also join the Pittsburgh staff.

ALUMINUM CO. OF AMERICA, Pittsburgh, Pa., announces that the company has made plans to construct a large, new plant near Davenport, Iowa, for rolling aluminum sheet and plate. The plant, which will cost more than $30,000,000, will have the capacity to produce more than 10,000,000 pounds of sheet and plate per month. Approximately 2000 workmen will be employed at the new plant.

P. A. PATTERSON CO., 3115 N. Broad St., Philadelphia 32, Pa., has been appointed distributor for Reed cylindrical-die thread rollers and RTD thread rolling dies manufactured by the Rolled Thread Die Co., Worcester, Mass., in the territory covering eastern Pennsylvania, southern New Jersey, northern Virginia, Delaware, and the District of Columbia.

AMERICAN SOCIETY FOR TESTING MATERIALS announces its removal from 260 S. Broad St., Philadelphia 2, Pa., to permanent headquarters in its own building at 1916 Race St., Philadelphia 3, Pa. The new quarters will provide the additional space required for the expansion of the Society's staff.

ALVAH SMITH has been appointed advertising manager of the machinery department of the R. D. Wood Co., Philadelphia, Pa. He has been associated with the company in various capacities for the last twenty years.

Alvah Smith, Recently Appointed Advertising Manager, Machinery Department, of the R. D. Wood Co.

COLONEL W. F. ROCKWELL, chairman of the board and president of the Rockwell Mfg. Co., Pittsburgh, Pa., has been elected a member of the board of directors of the United Engineering & Foundry Co., Pittsburgh, manufacturer of heavy-duty machinery for the steel industry.

J. L. KLEIN has been appointed director of research of the Jessop Steel Co., Washington, Pa., manufacturer of electric melted specialty steels. Prior to joining the Jessop Steel Co. in 1943, he was with the Eastern Research Laboratory of the Crucible Steel Co.

B. C. O'BRIEN has been elected president and general manager of the Bury Compressor Co., Erie, Pa. He was previously associated with the Roots-Connersville Blower Corporation in the capacity of vice-president and sales manager.

M. G. SEDAM has been appointed vice-president in charge of research and production for the Alloy Rods Co., York, Pa., manufacturer of stainless and alloy welding electrodes. He was previously director of research.

J. K. MAHAFFEY & SON, 1006 Pitt Bank Bldg., Pittsburgh, Pa., have been appointed representatives of the BAKER INDUSTRIAL TRUCK DIVISION OF THE BAKER-RAULANG CO., Cleveland, Ohio, succeeding CRISS & MAHAFFEY.

WILLIAM K. STAMETS CO., Jenkins Arcade Bldg., Pittsburgh 22, Pa., has been appointed representative for the line of lathes and production machinery built by the SIDNEY MACHINE TOOL CO., Sidney, Ohio.

VOSS MACHINERY CO., 2882 W. Liberty Ave., Pittsburgh, Pa., has been appointed distributor for the "Millgrinder" grinding machine made by the MONROE TOOL & MFG. CO., of Monroe, Mich.

ALFRED B. DRASTRUP has been appointed manager of the alloy steel sales department of A. M. Byers Co., Pittsburgh, Pa. He has been connected with the company since 1931.

JAMES M. UNDERWOOD has been elected president of the Vulcan Mold & Iron Co., Latrobe, Pa., succeeding EDWARD R. WILLIAMS, who has resigned.

England and Canada

E. W. BLISS (England) LTD. has concluded arrangements with THOMAS FIRTH & JOHN BROWN, LTD., for the manufacture in Sheffield, England, of Bliss presses of welded steel construction. The Bliss equipment that will be built in the Firth-Brown factory consists principally of large mechanical stamping presses, such as are used in the automotive, railroad, and aircraft industries. This arrangement will permit the Bliss company's own works in Derby, England, to concentrate on the construction of medium and small size presses, can-making machinery, and dies.

C. H. STRASSER has been appointed works manager of the electric furnace plant at Chippawa, Ontario, of the Norton Co., Worcester, Mass.

* * *

Employers' Guide for Setting up Apprenticeships for Veterans

In response to the growing demand for information on how to establish an apprenticeship program for training veterans, the Apprentice-Training Service, U. S. Department of Labor, has issued a booklet entitled, "Setting up an Apprenticeship Program — a Guide to Employers in Training Veterans for the Skilled Trades."

The booklet explains in detail the various provisions to include in an apprentice training program, as well as the steps that an employer must take to obtain approval as a qualified training institution for veterans. A complete list of state agencies designated to approve business establishments and educational institutions under the "G. I. Bill of Rights," as well as other agencies with whom the employer will have dealings, is given.

Among other things the booklet presents a formula on how to allocate training time to the various work processes of a trade, and provides suggestions on wage rates for apprentices, securing the cooperation of employes, etc. Copies of the booklet can be obtained by writing to the Apprentice-Training Service, U. S. Department of Labor, Washington 25, D. C.

For Heavy Duty Forged Shafting

USE *JALLOY* FOR LONG SERVICE

J&L STEEL

Jalloy is a special alloy steel, made by Jones & Laughlin for machine and equipment parts that must stand up under the most severe operating conditions. It is ideal for shafting that is subjected to repeated shocks, torsion and dynamic stress. Jalloy is readily forged and heat treated. Write today for information.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

New Books and Publications

LABOR-MANAGEMENT ECONOMICS. By W. V. Owen. 121 pages, 5½ by 8 inches. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, $2.

This exceedingly timely book is based on the thesis that a better understanding of economics by management and labor will improve industrial relations. It is believed that the long-run success of management policies and programs, as well as of labor policies and programs, is controlled to some extent by the economic soundness of these policies and programs. The material is divided into two parts — employer-employe economics and the economic framework. Part I deals with management; production, risks, and costs; economics of wages, labor, and unionism; and industrial relations and economics. Part II covers the economic factors in producing, marketing, and consuming goods, including price levels, government economic functions, and economic systems.

NEW CAREERS IN INDUSTRY. By John M. Amiss and Esther Sherman. 227 pages 5½ by 8 inches. Published by Whittlesey House, M Graw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $2.50.

At the present time when so many young men are trying to find their right place in industry, a book containing specific occupational information should be of especial value. This book has been written to aid returning veterans and other young men in choosing a career intelligently. It describes the various opportunities confronting the young man today in the industrial field. The reader is introduced to each job—machine operator, machinist, toolmaker, diemaker, patternmaker, inspector, supervisor, master mechanic, engineer, and many others—and given an outline of the duties, working conditions, wages, and qualifications of these jobs. An idea is also given of the opportunity each job has for advancement.

ELECTRONICS IN INDUSTRY. By George M. Chute. 461 pages, 5½ by 8½ inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price, $5.

This book describes and explains for the man with little technical training a wide variety of electronic equipment used in industry. It explains what the vacuum tube is, and outlines the industrial use of tube circuits. The subject is presented for the users of equipment already designed and built, and has little value for the designer or builder of electronic equipment. The text is based on an evening study course in industrial electronics conducted by the author for several years for the University of Michigan Extension Service. No attempt has been made to picture the application of electronic equipment or to discuss the results obtained, the object being merely to show how tubes and tube-operated circuits work.

SELECTING AND OPERATING A BUSINESS OF YOUR OWN. By Gustav E. Larson, Robert H. Johnson, and Walter M. Teller. 364 pages, 5½ by 8 inches. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. Price, $3.

To the young men who are desirous of starting a small business of their own this book should be of considerable interest. It contains practical plans for operating seventy-five small businesses, discussing such important questions as how much capital investment is needed, how to set up the particular shop or service selected, problems of financing, location, advertising, record keeping, etc.

THE STORY OF THE ATOMIC BOMB. By C. H. Douglas Clark. 52 pages, 5½ by 8½ inches. Published by The Machinery Publishing Co., Ltd., 17 Marine Parade, Brighton 1, England. Price, 3/6.

This little book contains a popular review of the principal discoveries that have led up to the production of the atom bomb. The author is a lecturer in the department of inorganic and physical chemistry at Leeds University, and has made a special study of atomic and molecular structure for many years. Mathematical treatment has been avoided.

Coming Events

AUGUST 22-24 — National West Coast Transportation and Maintenance Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the New Washington Hotel, Seattle, Wash. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 11-12 — National Tractor Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Schroeder, Milwaukee, Wis. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 16-20 — 1946 Exhibit and conference of the INSTRUMENT SOCIETY OF AMERICA at the William Penn Hotel in Pittsburgh, Pa. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

SEPTEMBER 18-19—Fall meeting of the AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION at the Homestead, Hot Springs, Va. Executive secretary, Thomas A. Fernley, Jr., 505 Arch St., Philadelphia 6, Pa.

SEPTEMBER 30 - OCTOBER 3 — Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Boston, Mass. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

OCTOBER 3-5 — Aeronautic meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

OCTOBER 16-17 — National Transportation and Maintenance Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Knickerbocker, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 7-8 — National Fuels and Lubricants Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Mayo Hotel, Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 17-22 — Annual meeting of the AMERICAN WELDING SOCIETY at Atlantic City, N. J., in conjunction with the National Metal Congress and Exposition. For further information, address American Welding Society, 33 W. 39th St., New York 18, N. Y.

NOVEMBER 18 - 22 — NATIONAL METAL CONGRESS AND EXPOSITION in Atlantic City, N. J., under the auspices of the American Society for Metals. For further information, address managing director, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

DECEMBER 2-4—National Air Transport Engineering Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Edgewater Beach Hotel, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 2-6—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. Clarence E. Davies, secretary 29 W. 39th St., New York 18, N. Y.

DECEMBER 2-7—SEVENTEENTH NATIONAL POWER SHOW at Grand Central Palace, New York. Further information can be obtained from the manager, Charles F. Roth, Grand Central Palace, New York 17, N. Y.

* * *

Power of Jet Plane Increases with Speed

The recently revealed 800-pound jet propulsion engine built by the Westinghouse Electric Corporation for the Navy delivers 1500 H.P. at moderate plane speeds. But power increases with speed, and at 500 miles an hour the same engine will yield 2000 H.P. or 2½ H.P. for each pound of engine weight. If a plane could go 1000 miles an hour, the engine would produce 4000 H.P.

OTIS ELEVATOR COMPANY

Tells Independent Investigator

"Phillips Screws Licked 3 Serious Problems..."

The investigator, from James O. Peck Co., industrial research authorities, is studying assembly methods in leading plants. At Otis Elevator Co. he asked the same questions you would ask – and here are some of the money-saving reasons they gave him for using Phillips Screws.

"THEY BANISHED BURRS – always a hazard in equipment used by the public. Slotted screws burred easily, and if unnoticed in assembly, might later scratch limbs or snag clothing, especially on a moving escalator, with resulting damage claims. If the burr was noticed, the screw had to be replaced, wasting time.

"THEY DISCOURAGED TAMPERING. When slotted screws were used, people could turn them out with a coin, a nail file, or even with finger nails. This malicious mischief is a constant 'headache' in buildings used by the public. Phillips Screws are relatively tamper-proof.

"THEY ENDED DRIVER SKIDS. Plates and panels scarred by slipping drivers are a serious problem to us, since our products are assembled in the field. Refinishing by expert touchup men comes high. Sometimes new parts must be procured from the plant, and the cost of time lost in installation mounts fast. The Phillips driver stays in the recess, doesn't skid."

His complete, idea-crammed report, with others now ready, and more to come, comprise a practical manual of modern assembly practice – a guide to savings you can't afford to miss. All types of products are covered – metal, plastic, wood. The coupon will bring the reports ready now and the rest as they are issued.

Whatever You Make, There Are Savings Suggestions for You in These Reports. They Are FREE . . . Mail the Coupon Today!

"SLOTTED HEADS COULDN'T TAKE the 'oomph' we use when we set 'em up, sometimes with a cross bar on the driver, without breaking or burring. Phillips Screws can – they start easier, drive easier, too."

"PHILLIPS SCREWS ADD GOOD LOOKS to safety," said Otis engineers. "The ornamental recess blends with the modern, finished appearance of the escalators – saves us getting the special head designs we formerly used."

PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
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Corbin Screw Div. of American Hdwe. Corp.
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International Screw Co.
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26 SOURCES

Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg.Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Wolverine Bolt Company

Phillips Screw Mfrs., c/o Horton-Noyes
2300 Industrial Trust Bldg., Providence, R. I.

Send me reports on Assembly Savings with Phillips Screws.

Name.....

Company.....

Address.....

.....

Obituaries

Charles A. Corrigan

Charles A. Corrigan, in charge of advertising for the Rockford Machine Tool Co., Rockford, Ill., died on June 15 at the age of sixty years. Mr. Corrigan was born in South Boston, Mass., on June 10, 1886. After graduating from high school, he took an evening course in mechanical engineering at the Lowell Institute. He started work in 1904 in the drafting-room of the General Electric Co. After a brief period there, he obtained a position with the American Warp-Drawing Machine Co., manufacturer of textile and special machinery, where he was engaged in design and research and development work. From 1918 to 1927, he was associated with MACHINERY in the advertising and field service departments. In 1927, he started an advertising agency of his own in Rockford, Ill., which he was forced to terminate in 1942 because of poor health. He had been handling the advertising for the Rockford Machine Tool Co. since January, 1943. Mr. Corrigan is survived by his wife and a son, Richard F., who was a First Lieutenant in the Army, and had received his discharge shortly before his father's death.

ERIC E. SOMMER, sales engineer with The Linde Air Products Company, New York, died on June 5 as a result of the recent fire at the La Salle Hotel in Chicago. He was thirty-four years of age. Mr. Sommer was born in Hove, England, in 1912, and came to this country with his parents as a child. He attended high school in Buffalo, N. Y., and received his BS degree in chemical engineering from the University of Michigan in 1935. Mr. Sommer had been connected with Linde Air Products since 1935. Employed as an associate engineer at the Tonawanda, N. Y., plant, he later became assistant to the research manager and was then transferred to the New York office. He was made a sales engineer for the New Products Division of the company in April, 1945. Mr. Sommer was a member of the American Institute of Chemical Engineers. He is survived by his wife and a three-year-old daughter.

W. A. GIVENS, executive vice-president and a director of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa., died on May 29 in the Allegheny Valley Hospital at Tarentum, following a cerebral hemorrhage suffered in his office at Brackenridge. Mr. Givens was born in Pittsburgh on November 7, 1885. He became connected with the Allegheny Steel Co. in 1925 as superintendent of the merchant mill after many years of operating experience with other steel companies. In 1926, he was promoted to the position of alloy production manager, and two years later was appointed general superintendent, a position he held until 1932, when he was made general manager. In 1938, he was elected a member of the board of directors and was made vice-president in charge of manufacturing. He was elected executive vice-president in 1944.

RUDOLPH LOUIS SUHL, manager of the nickel sales department of the International Nickel Co. at New York, died suddenly on June 10 at his home in Plainfield, N. J., in his sixty-fourth year. Mr. Suhl had been associated with the International Nickel Co. for over forty-three years. He joined the company's Orford Works in Bayonne, N. J., on May 1, 1903, serving in the Chemical Laboratory, and later became superintendent of the calcining department at that works. When the Development and Research Division of the company was formed in New York in 1922, Mr. Suhl was one of the original staff. After serving with this division for some years, he became assistant manager of the nickel sales department in 1929, and was made manager of that department in 1932.

GEORGE B. EVANS, plant manager of the Wagner Electric Corporation, St. Louis, Mo., died suddenly on May 25 of a cerebral hemorrhage at the age of sixty-five years. Although Mr. Evans had been under the care of a physician for some time, he attended to his duties at the plant until shortly before the time he was stricken.

Mr. Evans started to work with the company in 1904 as a tool- and die-maker, and rose through the ranks to become general superintendent in 1921, which position he held until last February, when he was named plant manager. During the war period he was management member of the St. Louis War Labor Board, and was also a member of the Regional War Labor Board which met in Kansas City, Mo. Mr. Evans is survived by his wife and two sons.

WILLIAM B. PATTERSON, who recently retired as president and treasurer of the Patterson Tool & Supply Co., Dayton, Ohio, died on May 20, after an illness of two weeks. Mr. Patterson was eighty-nine years old. He went to Dayton in 1881, and with his father, established a machine and tool business. Starting on a small scale, the tool store grew until it served a wide range of industries. It was this company that sold the Wright brothers their first machinery when the Wright bicycle shop was established in Dayton. Some of that machinery, bearing the Patterson name plate, is now on exhibit at the Ford Museum in Detroit. The National Cash Register Co. also was supplied with its first lathe by the Patterson company.

CHARLES E. CUMMINGS, assistant secretary of Raybestos-Manhattan, Inc., Passaic, N. J., died on June 6 at the age of seventy-nine. Mr. Cummings was one of the fifty-two year pioneers of the Manhattan Rubber Division, and was probably the one who had the record of the longest number of years in the rubber industry. Mr. Cummings was born in Brooklyn on June 27, 1861. He entered the rubber industry in 1881, when he became employed by the New York office of the New York Belting & Packing Co. He joined the Manhattan Rubber Division as a bookkeeper in the New York office in 1894.

C. M. SUTTON, vice-president of McCrosky Tool Corporation, Meadville, Pa., died suddenly of a heart attack on June 14 at his home in Detroit. Mr. Sutton joined the McCrosky sales force in 1911 In 1919, he went to Detroit as the manager of the company's sales office there. He continued in active management of that office up to the time of his death. Mr. Sutton was also a director of the Midwest Tool & Mfg. Co. of Detroit.

JERRY TYLER, president and founder of the Tyler Fixture Corporation, Niles, Mich., died on June 9 as a result of the La Salle Hotel fire in Chicago.

* * *

Reduction Gear Development Brings Commercial Gas-Turbine Planes Closer

Geared gas-turbine airplanes will harness the power of a turbine engine to turn a propeller instead of exhausting a high-velocity jet into the atmosphere as do present jet planes. A gas turbine, however, if attached directly to a standard propeller would turn it at about 12,000 R.P.M., whereas propeller-tip speed limitations are reached at approximately 750 miles per hour. Thus it becomes necessary to have a reduction gear which will add little to the over-all weight of the plane, but will transmit power to the propeller at a speed reduction of 10 to 1.

Such a reduction gear has been designed and built at the Nuttall Gearing Division of the Westinghouse Electric Corporation. The reduction gear, including a propeller shaft support, weighs only about one-thirtieth as much per horsepower as an industrial gear unit. The drive consists of one set of high-speed planetary gearing that transmits its energy to a low-speed planetary gear set, all mounted in an aluminum housing. Special carburized and nitrided steels are used in making the gears, and they are machined to high accuracy. Bearing and journal surfaces are polished to a surface having an error of not more than five millionths of an inch.

* * *

Hacksaw Blade Simplified Practice Recommendation

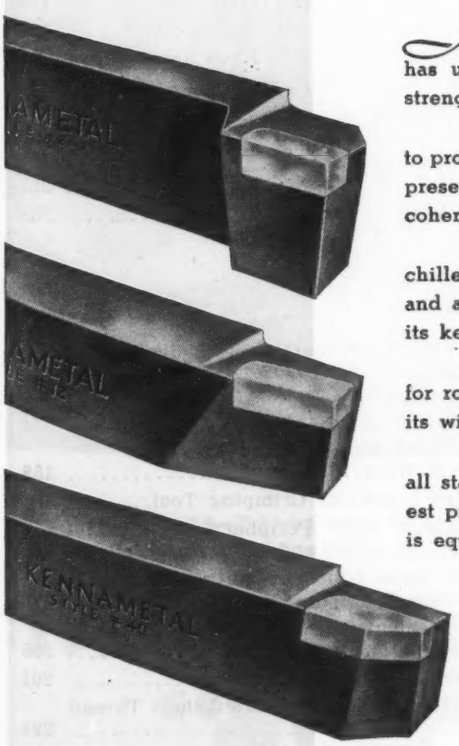
The National Bureau of Standards, United States Department of Commerce, Washington, D. C., has issued "Simplified Practice Recommendation R90-46" covering hacksaw blades. Those interested can obtain copies from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., at 10 cents per copy.

KENNAMETAL K6...

the 2 in 1 CAST IRON CUTTING GRADE

HARDNESS to resist ABRASION...

STRENGTH to resist SHOCK...



In providing a carbide for cast iron jobs involving rough or interrupted cuts it has usually been considered necessary to sacrifice some hardness for the sake of strength, with consequent shortening of tool life.

This is no longer necessary. Metallurgists of Kennametal Inc. have found a way to produce a 2 in 1 composition. It is hard *and* strong. These characteristics are both present to a high degree in Kennametal K6 grade, because of its uniform, strongly-coherent structure.

It has ample strength to withstand the shock of machining rough, sandy, or chilled castings, even though they are out of round, or have surface interruptions—and at the same time it has sufficient hardness to effectively resist abrasion, and hold its keen edge for a remarkably long time.

This new and improved tungsten carbide can be used with entire satisfaction for roughing, finishing, and precision boring. Scores of cases on record demonstrate its widespread effectiveness.

K6 blanks, and complete single point tools, are now available from stock in all standard styles and sizes. Use them on cast iron machining jobs to assure highest production with lowest tool cost. Remember also, that this grade of Kennametal is equally effective on milling—which is essentially interrupted cutting.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL *Inc.*, LATROBE, PA.

Classified Contents of This Number

Design, Fixture and Tool

Helical Cutter with Adjustable Blades—*By Charles F. Smith* 193
Simple Method of Duplicating Cam Surfaces on a Surface Grinding Machine—*By Fritz L. Keller*. 194
Lathe Set-Up for Spherical Turning 195

Design, Machine and Product

Designing Work for Bending—*By E. J. DeWitt* and *Harry S. Nachman* 154
Research on Closed-Impression Die Forgings 165
Spindle-Control and Collet-Operating Mechanism for Screw Machines—*By A. W. Jansson* 189
Prize Winners in Ingenious Mechanism Contest .. 192
Slides for Holding Drill Jigs to Table 195

Education, Trade and Engineering

Training Draftsmen at the Glenn Martin Plant ... 173

Heat-Treatment

Induction Hardening Speeds up Lead-Screw Production—*By Charles H. Parks* and *Dr. Joseph Libsch* 179

Management Problems

Production is the Only Bulwark Against Inflation. 156
Hundreds of Small Strikes Hold up Automobile Production 165
Increased Production the Solution to Economic Problems 178
Westinghouse Productive Power Exhibit 182
Safety Code for Industrial Use of X-Rays 187
Industrial Progress Starts Endless Chain of Activity 188
Seniority Rules Work Hardship on Able Young Men 188
Shall We Continue to Adopt This Kind of Foreign Ideas? 188
Change in Priorities for Purchasers of Surplus Machines 200

Materials, Metals, and Alloys

New Aluminum-Alloy Bearing Metal for Automobile Engines 153
Aluminum Pallets Save Handling Weight and Expense 156
Aluminum Bonded to Cellulose Core Forms New Building Material 163
Chemical Treatment of Highly Finished Metal Surfaces 166
Secret Wartime High-Temperature Alloys Now Available for Peacetime Use 183
Increasing Application of Aluminum 192
Stainless-Steel Parts Manufactured by Powder Metallurgy 196
Cleaning Process that Facilitates Bonding of Meehanite to Babbitt 196
Reinforced Plastic Resin Tested for Tooling Jigs. 196
Protective Oil Used as Drying Agent and Rust Preventive 196
Color Parkerizing Increases Corrosion Resistance of Iron and Steel 196
Flexible Diaphragm Cloth Resists Temperature Change 197
Silicone Compound Prevents Foaming of Aqueous Solutions and Emulsions 197
Passivating Process Permanently Blackens Stainless Steel 197
High-Conductivity Copper Casting Alloy for Electrical Use 197
New Entirely Aluminum-Faced Office Building ... 227
New Permanent-Magnet Materials Developed by General Electric Co. 236

Meetings and News of Societies

Gear Manufacturers Association Holds Thirtieth Annual Meeting 164
Detroit Meeting of A.S.M.E. Features Metal Cutting 226

News of Industry

Ford Research and Engineering Center Planned .. 168
Engineering News 174
A Good Navy Public Relations Job 187
Gearing Industry Continues to Show Increase 187
Westinghouse Awards Scholarships 191
Oil Exploration from Air Made Possible by "Flying Eye" 227
Counter Chronograph Provides Fast Method of Timing in Ballistic Tests 227
News of the Industry 238

Shop Practice

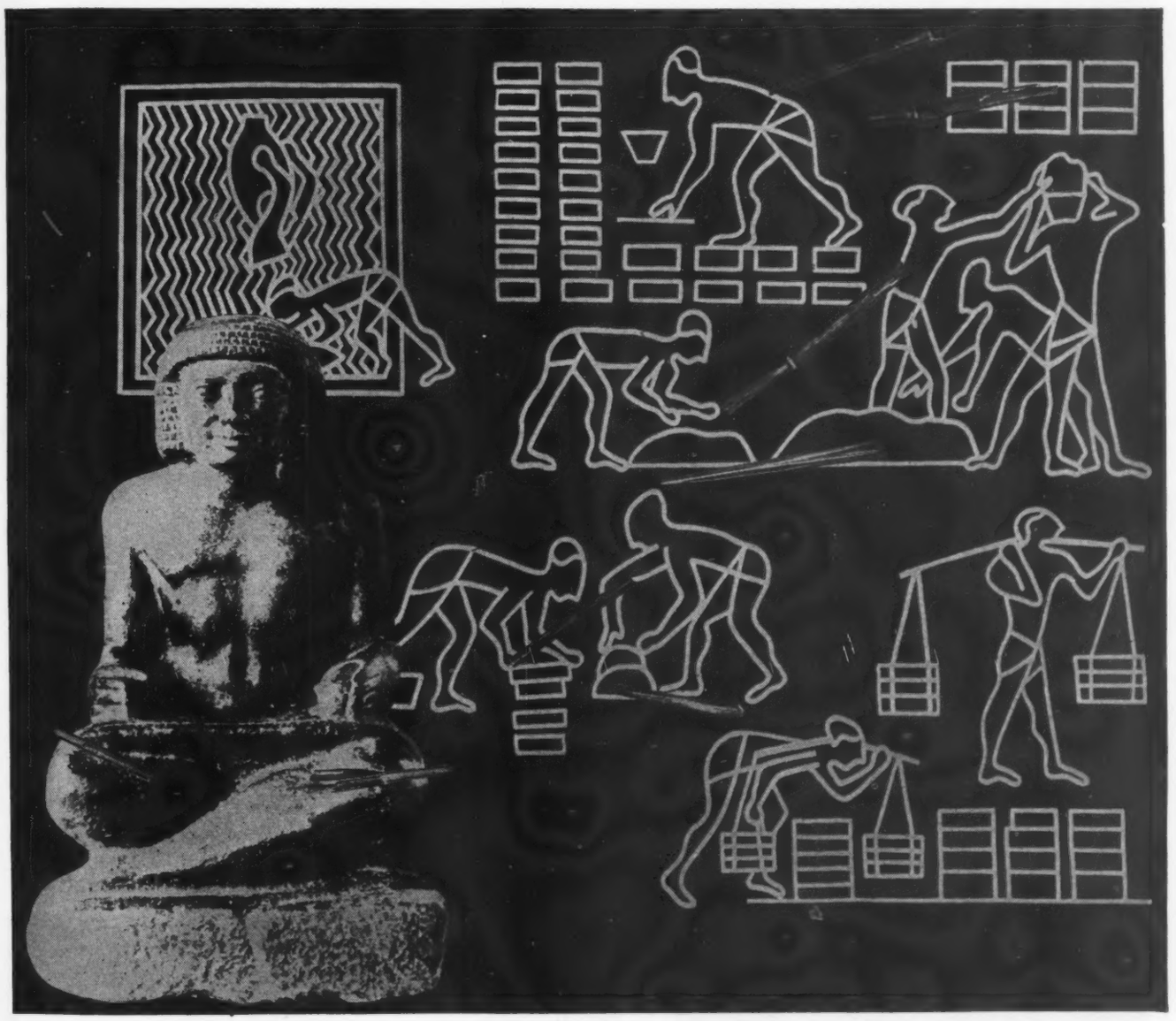
Ford Cylinder Sleeve Production Embodies Unique Engineering Ideas—*By Charles O. Herb* 139
Machining Stainless-Steel Valves—*By A. P. Nelson* 148
Production of Clad Steels by Rolling—*By Charles H. Wick* 158
Convenient and Ingenious Crimping Tool 168
Surface Grinding with Periphery of Straight Wheels—*By J. C. Arndt* and *W. S. Hallowell* 169
Obtaining Full Value from Power Hacksaw Blades—*By Benjamin Melnitsky* 176
Gisholt Two-Element Unbalance Measuring and Correcting Equipment 198
Shop Equipment News 201
Special Taps Greatly Increase Crankshaft Threading Rate 226

BRICKS WITHOUT STRAW

Long, long ago a penny-conscious Pharaoh tried to cut his cost corners by decreeing that bricks would be made without straw. He found out—the hard way—that scrimping on materials throws product performance and customer good will into full reverse.

Hardenability in steel is analogous to straw in bricks. Leave it out and you invite trouble in. Molybdenum steels combine good hardenability with economy, thus insuring good performance on a practical cost basis.

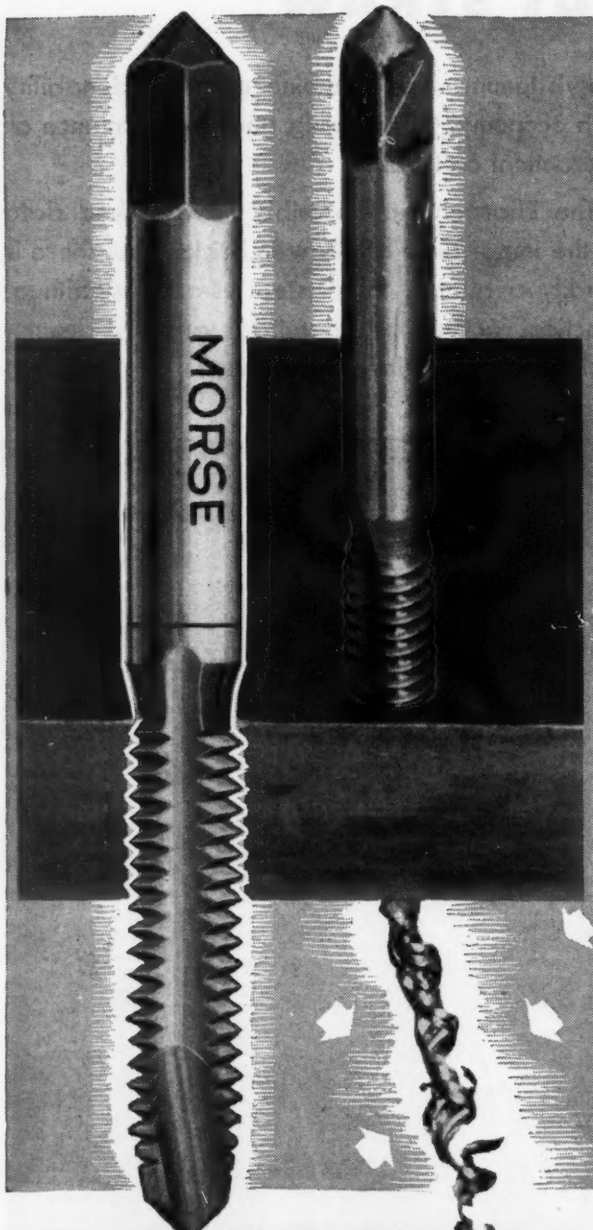
The Pharaoh may possibly have lacked data on the importance of straw in bricks—but there is readily available to all steel users a wealth of practical facts on the advantage of molybdenum-containing steels. Investigate *now!*



MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

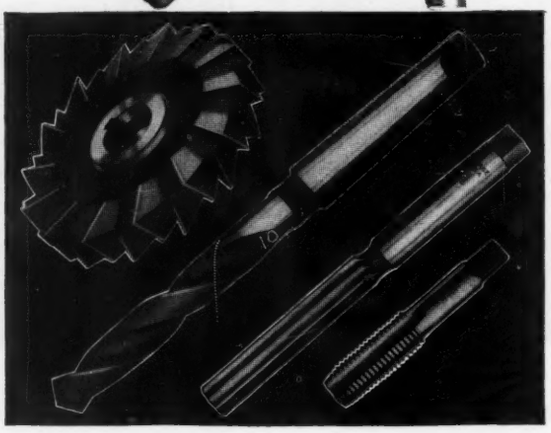
Climax Molybdenum Company
500 Fifth Avenue · New York City

MOLY



CHIPS

PROVE CUTTING EFFICIENCY OF MORSE TAPS!



MORSE two-fluted, spiral-pointed hand taps roll the chips ahead to prove cutting ease, speed and precision as they thread deep open-end holes. These taps effect measurable gains in quality and quantity production.

AS ALWAYS—THROUGH DISTRIBUTORS

MORSE THERE IS A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.
SAN FRANCISCO STORE: 1180 FOLSOM ST.

American Airlines had a shielding problem

"American Metal Hose" *found the answer*

THE PROBLEM:

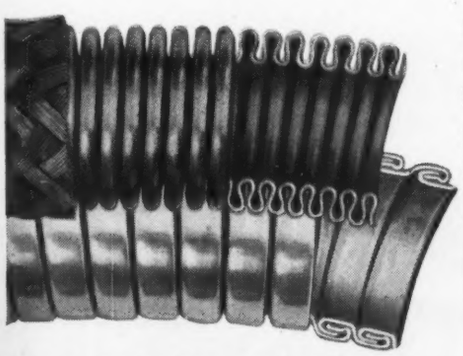
Ever since high frequency radio had been installed in aircraft, adequate ignition shielding had been a problem—fatigue cracking of the flexible metal shielding caused by continual vibration; moisture penetration of the conduit, causing electrical leakage and resulting in ignition failure, interrupted radio communication and schedule delays.

THE SOLUTION:

The answer to these difficulties was provided by the HTCD Shielding Conduit developed by the American Metal Hose Branch of The American Brass Company. Here is a strong, tough, corrosion and vibration-resistant, moisture-proof flexible metal tubing constructed of interlocked stainless steel core, with a covering of two specially-woven layers of tinned copper wire braiding, with brass ferrules, stainless steel nuts, and, finally, a molded Neoprene jacket.

THE RESULT:

American Airlines' flight-testing of this new shielding conduit revealed electrical characteristics never before approached in practice. After 3,712 hours and 42 minutes of operation, the conduit was in such excellent condition that tests were discontinued and it was accepted as standard. In addition, detailed cost studies revealed that the new shielding conduit cost approximately *half as much* per hour of operation as that previously used—and its ultimate life is still unknown. 46347



For practical industrial applications of American Seamless Flexible Metal Tubing and Interlocked Flexible Metal Hose, illustrated above, write for Publication SS-50.

ANACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY

AMERICAN METAL HOSE BRANCH

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

You can do those surfacing jobs better when you use

NORTON DISC WHEELS

NORTON ABRASIVES

WHEN a Norton abrasive engineer tackles your disc grinding jobs he's not limited to a few styles of discs – he has the complete Norton line of abrasives and bonds to choose from. As a result he can "tailor" the disc's grinding action to exactly meet your specific conditions – and that means lower surfacing costs.

And what's more, he can take advantage of all the newest Norton developments – such as free-cutting 57 Alundum abrasive and B-5 bond. On many disc grinding jobs, especially surfacing castings, this 57 Alundum, B-5 combination is showing remarkable results.

It will really pay you to let a Norton abrasive engineer make a survey of all your disc grinding jobs.

The Norton booklet "Disc Grinding —a Production Operation" will be sent on request. Ask for Form 1146M.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

W-1057

METAL-CUTTING LUBRICATION

Tool Life Increased 50% with Improved Cutting Oil

TRANSPARENT, STAIN-PROOF OIL PRODUCES GRATIFYING RESULTS

"We knew from certain operating conditions on a Landis automatic threading machine at a prospect's plant* that we could do a better job with Chillo No. 3 than was being done with a competitive product having approximately 14% lard and 1% sulphur compound.

Lubrication Engineer's Report

"The operation being performed was threading 14 to 16 foot bar stock from all grades of materials as to hardness and all sizes from ½ inch to 2 inches. On 16 foot bars of 1 inch, 1¼ inches and 1½ inches dimensions the average output was four bars of 64 feet per chaser grind with the 14% lard and 1% sulphur compound oil, and on under one inch bars the average output was 6 bars or 96 feet. The average speed or RPM while threading was 50 to 64 on the one inch and over, while the average on the under one inch was 64 to 84, depending on the hardness of the metal.

"Although the threads were good and acceptable with the oil in use, we produced a much more uniform and smoother thread with Cities Service Chillo No. 3. We increased the tool life from four bars on the one inch and over to six and sometimes seven or an average of 100 feet per chaser grind. The under one inch production per chaser grind was increased to nine bars or approximately 140 feet.

Tool Life Increased

"We stepped up production by increasing the RPM on the under one inch bars to 84, 90, or 106, depending on the hardness, and increased the larger stock bars to 64 and 84 RPM.

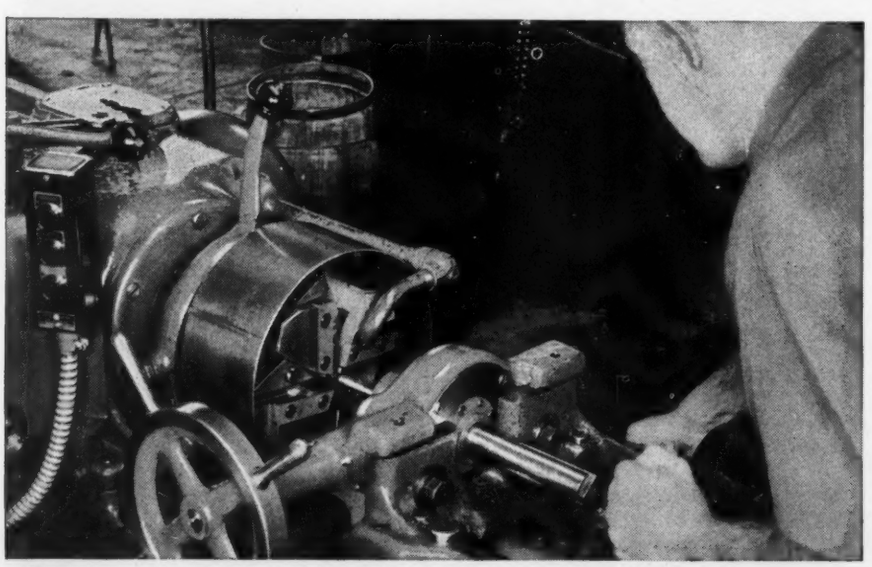
Production Stepped Up

"We were requested to supply a transparent oil that would not leave stains on the finished product. With this in mind and knowing that the plant would be very critical should some work become stained, we recommended Chillo No. 3 for the job with very gratifying results."

Cities Service makes available to any industrial organization operating in its marketing territories East of the Rockies, a highly specialized lubrication engineering service. If you're facing a metal-working problem—don't delay—call your local Cities Service office (in the South call Arkansas Fuel Oil Company), or write to Cities Service Oil Company, 60 Wall Tower, New York 5, N. Y.

Engineering Service Available

*Name on request.



CITIES SERVICE OILS
ONCE-ALWAYS

FOR EVERY LUBRICATION PROBLEM CALL Cities Service FIRST!

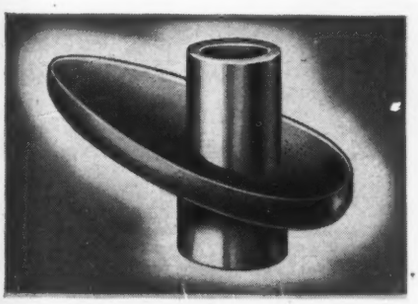
LEPEL SPARK-GAP CONVERTERS AT WORK

NO. 1

FASTER SOLDERING OF BRASS PARTS

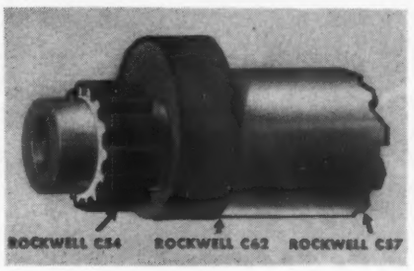
One middle-west manufacturer installed a Lepel induction heating unit to step up the soft soldering of brass parts. The operator assembles the brass flange, bushing and pre-formed solder ring on a ceramic pin attached to a conveyor belt. The belt carries the assemblies through a tunnel-type load coil, where the solder melts immediately, firmly and uniformly joining the parts.

The quick heating cycle ended discoloration, and as the pre-formed solder ring consists of a pre-determined amount, solder waste and excessive cleaning were eliminated. Only limiting factor in production is the speed of the belt and skill of the operator.



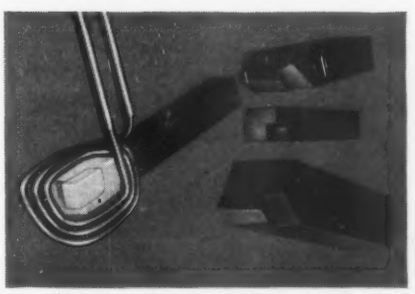
HARDENING TIME CUT 87.3%

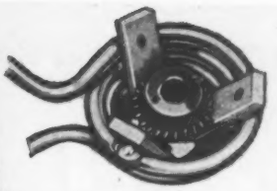
A manufacturer of precision machinery was differentially hardening areas on a machine part. Using the lead-pot method consumed 66.94 hours per hundred pieces. With the installation of Lepel High-Frequency Induction Heating equipment, the same operation is performed in 9.03 hours, a saving of 57.91 hours, or 87.3 per cent.



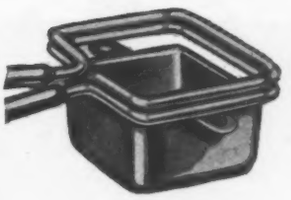
BRAZING COSTS REDUCED ON CARBIDE CUTTING TOOLS

Leading cutting-tool manufacturers are discarding the torch in favor of high-frequency induction heating in their brazing operations on tungsten-carbide tips. They find that it cuts brazing time, eliminates all guess-work, and insures a uniformly sure bond at a substantial saving of both time and money. Today, the trend in tool rooms is toward this same technique for tool salvaging and tip replacing.





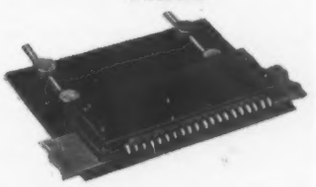
HARDEN



SOLDER

BRAZE

MELT



ANNEAL
STRESS RELIEVE
PREHEAT
NORMALIZE

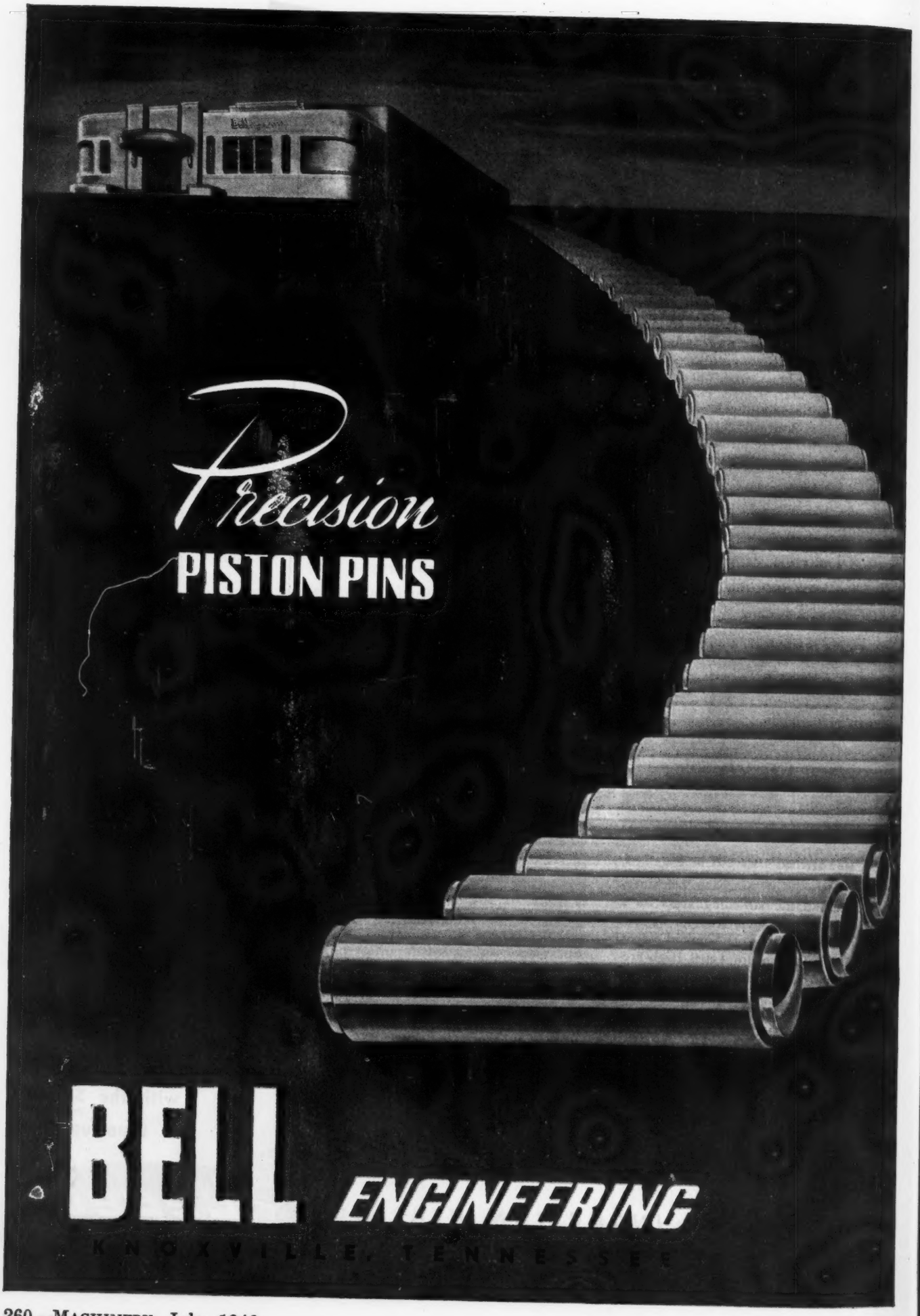
. . . ferrous and non-ferrous metals with the *SAME* Lepel unit

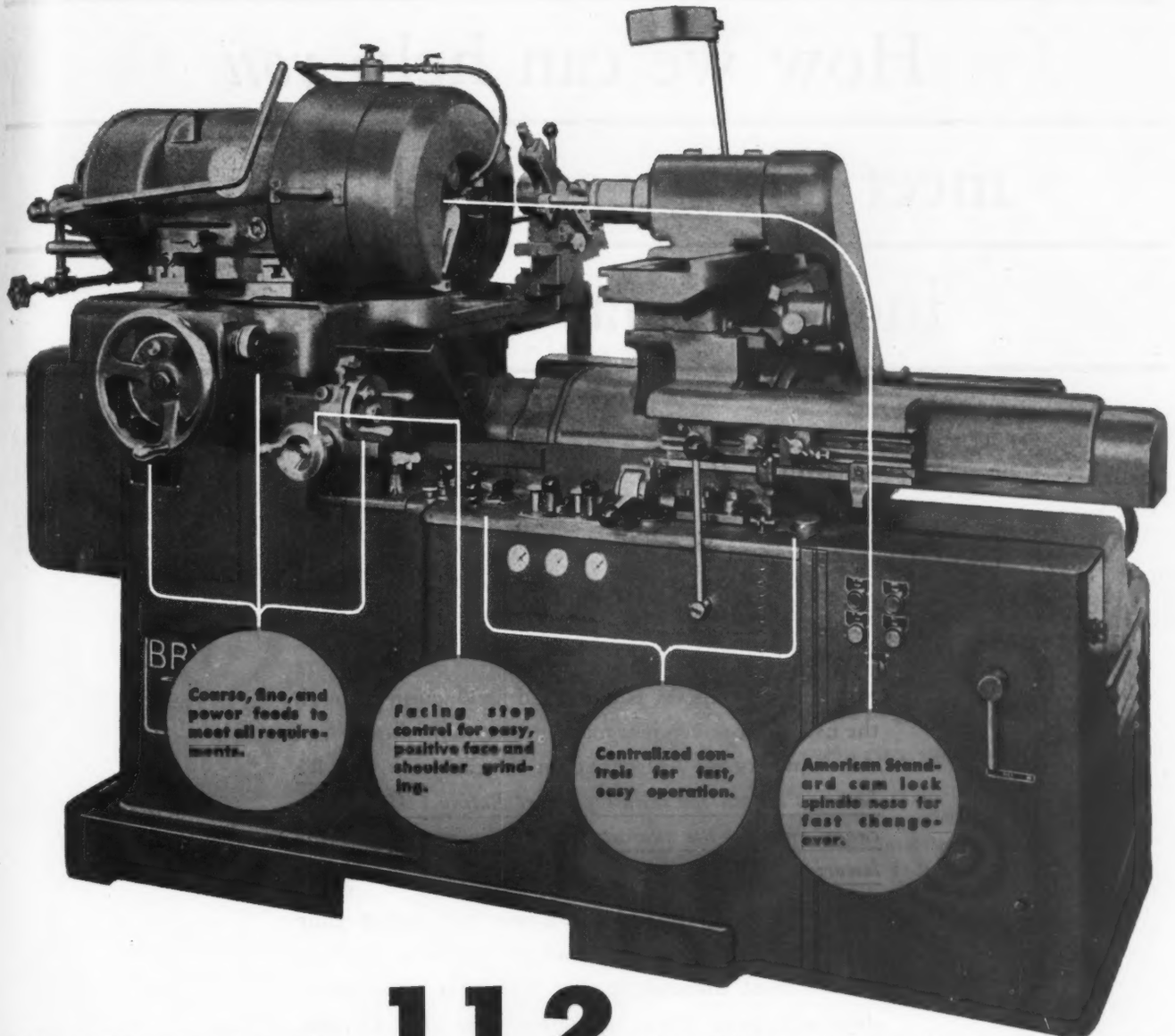
IF YOU HAVE A PROBLEM in joining, heat treating or melting of ferrous or non-ferrous metals, chances are that a Lepel High-Frequency Induction Heating Unit can help you do a better, faster, more economical job. Lepel metallurgists and field engineers will be glad to make a thorough study of your specific problem, and help you put the right portable, compact, Lepel unit on the job. Call, or write, Lepel High Frequency Laboratories, Inc., 39 West 60th Street, New York 23, N. Y.

Note: Our new catalog is just off the press. Send for it.

PIONEERS IN INDUCTION HEATING

LEPEL High Frequency INDUCTION HEATING UNITS


Precision
PISTON PINS
BELL ENGINEERING
KNOXVILLE, TENNESSEE


Coarse, fine, and power feeds to meet all requirements.
Facing stop control for easy, positive face and shoulder grinding.
Centralized controls for fast, easy operation.
American Standard cam lock spindle nose for fast change-over.

The BRYANT NO. 112 is the Ideal Internal GRINDER for Small Lot Production

From stem to stern, the Bryant No. 112 Internal Grinder is designed for small lot production. It is truly the *ideal* tool room machine, because every lever, every control, every part was planned to speed the production of short runs or single parts.

There are three feed controls—one for coarse feed for setup, another for power feed for production, and a third for fine feed for precision.

An American Standard cam lock spindle nose allows fastest change of chucks and holding fixtures.

All controls are centrally located so that all of the operator's motions are easy and natural—more work produced with less fatigue.

A universal facing stop (standard equipment) makes face and shoulder grinding an easy, positive operation.

These are only highlights—for complete details on this "ideal" tool room internal grinder, just . . .

Send for the Man from Bryant.

Write for new catalog on the No. 112

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

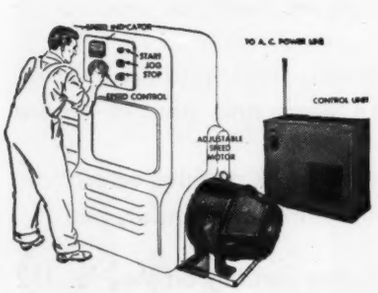
How we can help *you* meet the greatest challenge industry has ever faced

WAGES go up and up, along with other costs. Prices lag behind. Some relief may come from outside sources but, primarily, the problem of pushing production *up* and holding costs *down* must be solved by each individual company for itself. Here lies the greatest challenge industry has ever faced.

One sound answer is increased production through the use of more efficient machinery and methods. And this is where we feel confident we can help you. *We have yet to find the industry where Reliance V★S Drive cannot improve the quantity and quality of output, while lowering costs.*

A Reliance Application Engineer will survey your operations, then show you where and how you can benefit most through use of V★S—*the All-electric, Adjustable-speed Drive, operating from A-c. Circuits.* Just phone the nearest Reliance office or write us direct for Bulletin 311.

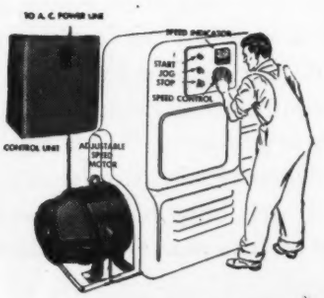
RELIANCE ELECTRIC & ENGINEERING CO.
1077 IVANHOE ROAD • CLEVELAND 10, OHIO
Branch Offices in Principal Cities



ROTATING SYSTEM
(1 to 200 hp.)

RELIANCE V★S DRIVE

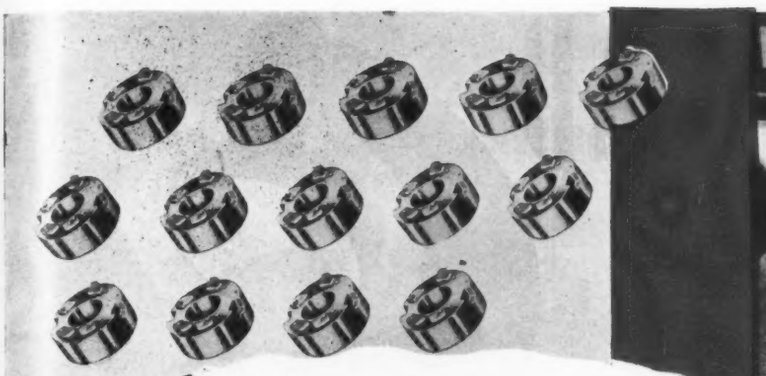
Reliance V★S Drive provides unlimited flexibility of machine operation. Starting, stopping, speed changing, reversing, maintenance of proper tension and other controls are exercised automatically or manually from nearby or remote stations.

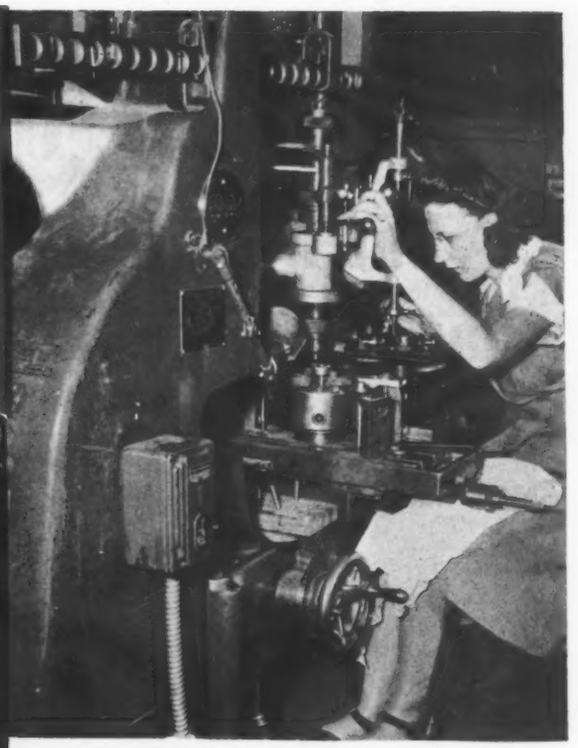


ELECTRONIC SYSTEM
(1 to 5 hp.)

RELIANCE A-C D-C MOTORS

"MOTOR DRIVE IS MORE THAN POWER"





Injection Molds Completed

5 TIMES FASTER ON A GORTON

3-DIMENSIONAL PANTOGRAPH

JOB FACTS

NAME OF PART—Injection Mold.

MATERIAL—Tool Steel (oil hardening).

MACHINE—Gorton 3-Dimensional Engraver Model 3-L.

ATTACHMENTS—Standard three jaw chuck mounted on table.

TOOLS USED—Special Cutters ranging from .035" dia. to .340" dia.

TEMPLATE USED—2 to 1 frill shape master.

FORMER TIME—15 hours per mold.

PRESENT TIME—3 hours per mold.

ACCURACIES—All dimensions held to .0005".

Machining Time Reduced from **15** *Hours to* **3** *Hours per Mold*

ACCURACIES HELD TO .0005"

Here's an example of the type of performance you'll get on a Gorton 3-Dimensional Pantograph Engraving Machine. This large manufacturer experienced difficulty in the production of these injection molds. Time required was 15 hours per mold. Accuracies were hard to maintain. Machine down-time was excessive. Man hours were wasted.

In an effort to remedy these, the job was tooled-up on a Gorton 3-Dimensional Engraving Machine. First an enlarged master template was cut. Then, using this as a pattern, the desired molds were turned out at the correct size at the rate of one every 3 hours. The other disturbing factors were also remedied. Dimensions were held to .0005" due to Gorton pantographic reduction method. Down-time was drastically reduced. Man hours were conserved.

QUALITY WORK ON A PRODUCTION BASIS

Gorton Pantograph Machines are noted for the consistency with which they turn out quality work on a production basis. They are available in both 2 and 3-dimensional models to handle many types of reproduction assignments. They can be used with high efficiency on any machinable material and their operation is extremely simple.

HOW TO PREDETERMINE THE RESULTS OF TOOLING YOUR JOB ON A GORTON PANTOGRAPH

Send detail prints or a work sample to Gorton Engineering Service at the address below. Tooling information and production estimates will be furnished promptly—no charge or obligation. You can then predetermine the possible improvement over your present methods.

GEORGE GORTON MACHINE CO.

1307 RACINE STREET, RACINE, WISCONSIN, U.S.A.

FREE ADDITIONAL INFORMATION

Get the details on Gorton Pantographs and other Gorton machines by sending today for your copy of Bulletin No. 1655.

A TOUGH GRIND

. . . but here is a press that can take it!

Grinding wheel production is rough on a press because the air around the press is constantly laden with abrasive dust. In spite of this, the Lake Erie press shown above has been turning out quality grinding wheels at a steady pace for six years at the Lackawanna, N. Y., plant of the Electro Refractories and Alloys Corp.

During the war years, this press worked 24 hours a day, seven days a week. Aside from routine servicing, about the only maintenance required was to true up the wear plates from time to time. The fine service-record of this sturdy press in producing thousands of grinding wheels is typical of the stamina and reliability of all Lake Erie presses. It will pay you to consult Lake Erie about your hydraulic press requirements.

The 2200-ton press illustrated is a self-contained unit with adjustable pressure control which assures maximum flexibility in producing abrasive wheels of various sizes and types.

LAKE ERIE ENGINEERING CORP.
170 Woodward Ave., Buffalo 17, N. Y.

Offices in Principal Cities and Foreign Countries

Leading manufacturer of hydraulic presses —all sizes and types—metal working... processing... plastic molding... rubber vulcanizing... stereotyping... special purpose.

Logan A NAME TO REMEMBER WHEN YOU THINK OF **BETTER** LATHES

at these 39 points* this *Logan* cabinet turret lathe has self-lubricating bronze bearings

LOCATION	NO. BEARINGS
Underneath Drive	8
Reverse Gear Bracket	2
Gear Box	10
Headstock	7
Automatic Apron	6
Carriage Assembly	4
Turret Assembly	2
*TOTAL	39

*All models of Logan Lathes are similarly protected.

SELF-LUBRICATING BRONZE BEARINGS

KEEP LOGAN LATHES READY TO RUN, ADD TO SERVICE LIFE, NEED FAR LESS OILING

The use of self-lubricating bronze bearings in place of plain bearings is typical of Logan Lathe design. The self-lubricating bearings are of a special bronze that is absorbent in texture and impregnated with lubricant. As a shaft revolves in one of these bearings, the lubricant is gradually released in a self-controlled flow which keeps an even film of oil over contacting surfaces. In this way, even though the lubricant is only infrequently renewed, the bearing surfaces are protected. In addition, the spindle on every Logan Lathe revolves on precision preloaded ball bearings that never need lubrication. This sustained lubrication is another factor in the sustained accuracy and long life of Logan Lathes. Get the full story of the advantages offered by the complete line of Logan Lathes from your nearby Logan Lathe dealer, or write direct for a catalog.

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10½". . . bed length, 43⅛". . . size of hole through spindle, 25/32". . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision-ground ways, 2 V-ways and 2 flat-ways.

J-1

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

You Can Clean These Filters

WITHOUT TURNING A VALVE

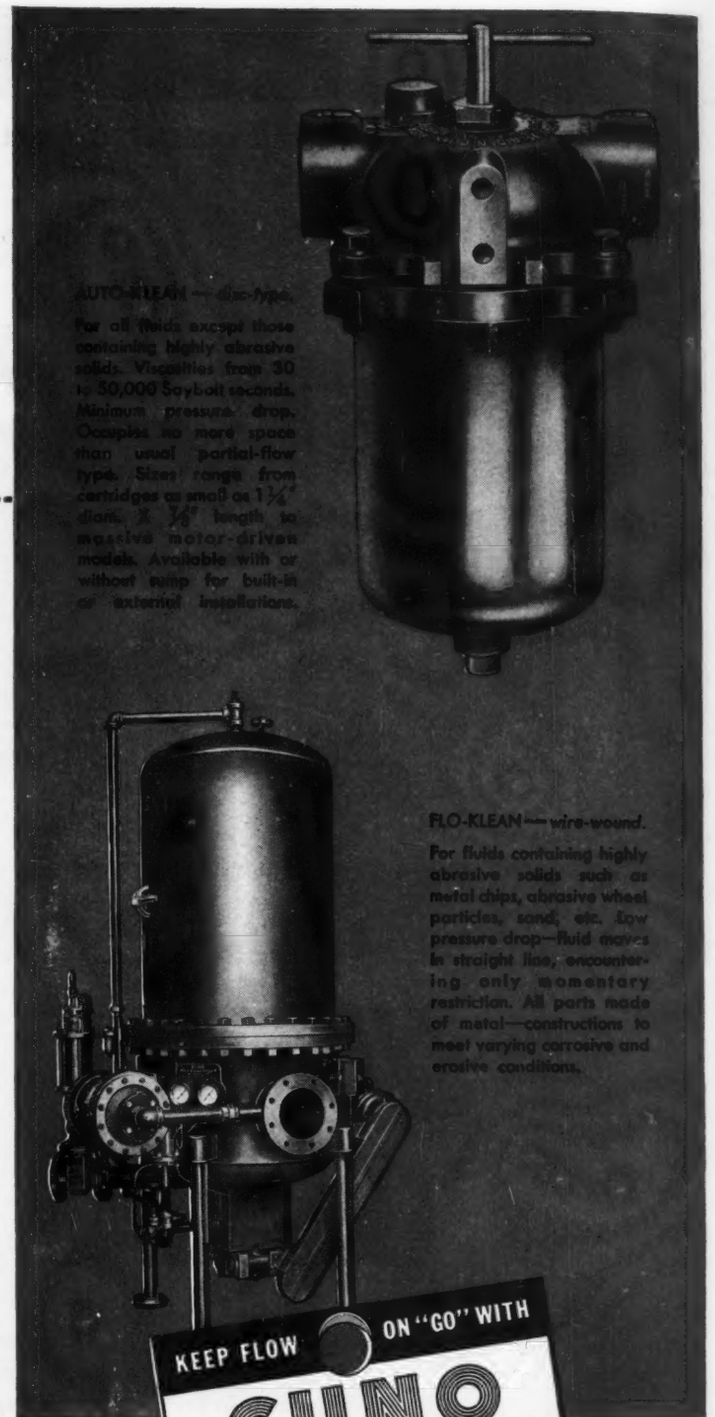
Flow never has to be stopped or diverted while a Cuno Filter is being cleaned. And you get this advantage without the expense — in space and investment — of a duplex installation.

Accumulated solids are removed . . . by turning a handle (with hand or motor) in the case of the Cuno Auto-Klean . . . by a motor-driven backwash system in the case of the Cuno Flo-Klean.

There is nothing, in either model, to remove or renew. The filter element is all-metal, non-collapsible. The only attention required is periodic emptying of the sump.

For positive cleaning action that is effective, as specified, down to .0025" particle size, specify Cuno. See Cuno catalog in SWEET'S for selection factors and specifications; or send coupon for complete Cuno catalog. Staff engineers are available for special recommendations.

For a Complete Cuno Catalog, send Coupon


AUTO-KLEAN — disc-type.
For all fluids except those containing highly abrasive solids. Viscosities from 30 to 50,000 Saybolt seconds. Minimum pressure drop. Occupies no more space than usual partial-flow type. Sizes range from cartridges as small as 1¼" diam. X ⅞" length to massive motor-driven models. Available with or without sump for built-in or external installations.
FLO-KLEAN — wire-wound.
For fluids containing highly abrasive solids such as metal chips, abrasive wheel particles, sand, etc. Low pressure drop—fluid moves in straight line, encountering only momentary restriction. All parts made of metal—constructions to meet varying corrosive and erosive conditions.
KEEP FLOW ON "GO" WITH
CUNO
ENGINEERED FILTRATION

CUNO ENGINEERING CORPORATION
1310 South Vine Street, Meriden, Conn.

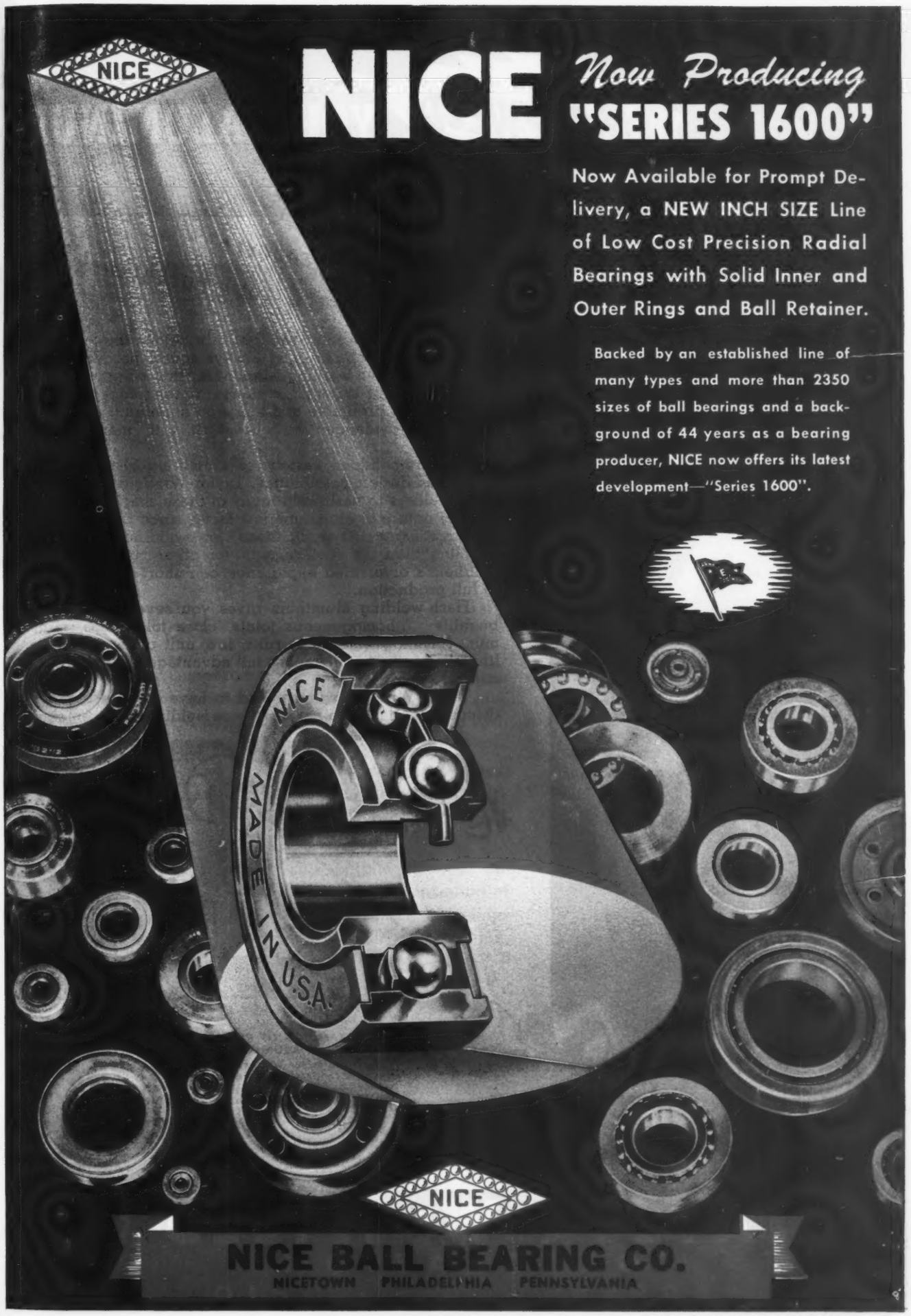
Please send me a free copy of QUICK FACTS. I am especially interested in the services checked.

☐Acids
☐Air
☐Alkali
☐Boiler Feed
☐Casein
☐Cleaning Solutions
☐Coatings
☐Compressed Air
☐Coolants
☐Cutting Oils
☐Dip Tank Systems
☐Enamel
☐Engine Fuel
☐Engine Lubricating Oil
☐Fuel Oil
☐Fuel Tar
☐Gases
☐Gasoline
☐Grease
☐Grinder Coolant
☐Hydraulic Oil
☐Japan
☐Lacquer
☐Lubricating Oil
☐Machine Tool Cutting Oil
☐Machine Tool Hydraulic Oil
☐Machine Tool Lubricating Oil
☐Nitrocellulose Solutions
☐Oils
☐Paint
☐Pyroxylin
☐Quenching Oil
☐Resins
☐Rust Proofing Compounds
☐Sizing
☐Solvents
☐Spray Systems
☐Tar
☐Test Stand Lubricating Oil
☐Varnish
☐Washing Compounds
☐Water
☐Wax

Name.....

Company.....

Address.....


NICE
NICE
Now Producing
"SERIES 1600"
Now Available for Prompt Delivery, a NEW INCH SIZE Line of Low Cost Precision Radial Bearings with Solid Inner and Outer Rings and Ball Retainer.
Backed by an established line of many types and more than 2350 sizes of ball bearings and a background of 44 years as a bearing producer, NICE now offers its latest development—"Series 1600".
NICE
MADE IN U.S.A.
NICE
NICE BALL BEARING CO.
NICETOWN PHILADELPHIA PENNSYLVANIA

FLASH-WELD YOUR ALUMINUM

Helps Your Product - - - - - - and Your Pocketbook!

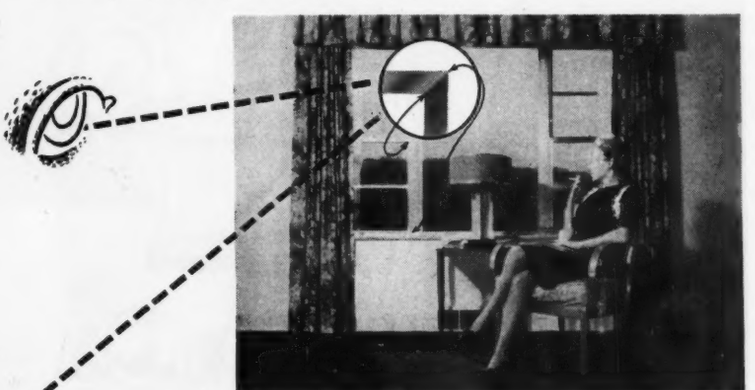
Co-operation between the fabricator and welding equipment manufacturer is always sound procedure. In the case of flash-welding aluminum, this co-operation is essential. Taylor-Winfield, a pioneer in resistance welding, can give you profitable assistance on aluminum and other metals, as evidenced by our work with many manufacturers.

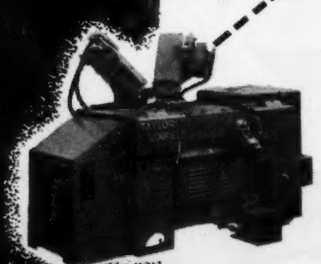
The tremendous variety of aluminum shapes offers numerous design possibilities. Taylor-Winfield has developed welders to flash-weld many of these shapes.

The nature of aluminum is a factor since the electrical and mechanical specifications for welding are more exacting than the requirements for other metals. Taylor-Winfield's diversified experience can short-cut your road to full production.

Flash-welding aluminum gives you several important benefits . . . homogeneous joints, close tolerances, minimum finishing time, long runs, low unit costs . . . and a finished product which takes full advantage of aluminum's natural beauty.

Taylor-Winfield will be glad to have a representative discuss your flash or other resistance welding requirements.





A FEW EXAMPLES OF FLASH-WELDING OF ALUMINUM

Window and screen frames; frames for bunks, bicycle rims, rings, trim and mouldings; and many other applications of flat, solid, tubular, and other shapes in extruded, wrought, cast, and forged aluminum alloys.

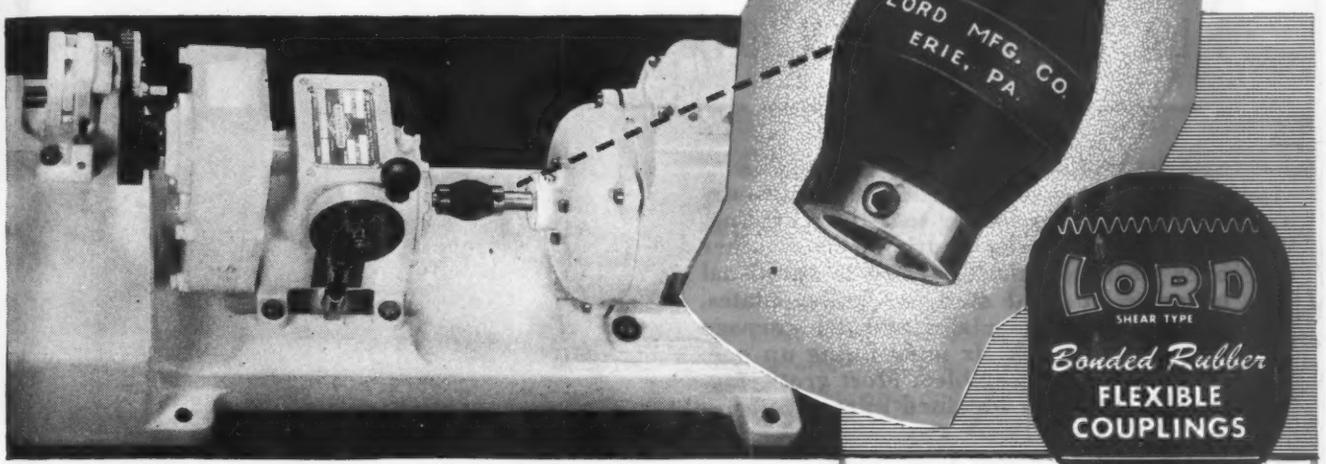
LEFT New, fast production Taylor-Winfield flash-welder with fixtures for the precision welding of mitered joints in extruded aluminum sections.

The TAYLOR-WINFIELD CORPORATION

WARREN . . . OHIO

A flexible FLEXIBLE COUPLING

All in One Piece



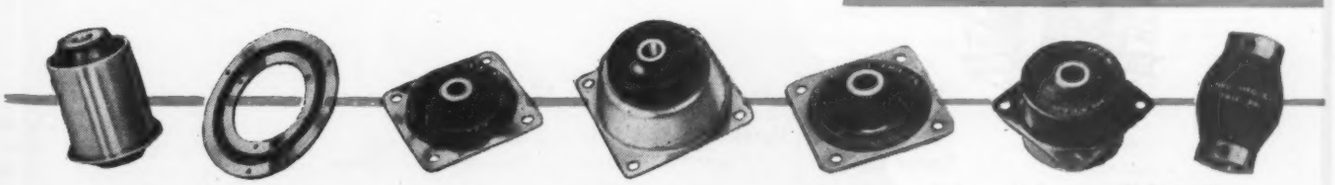
THE compact, one-piece Lord Flexible Coupling embodies the rubber bonded-in-shear principle to give the most efficient possible combination of strength with shock absorbing resilience.

Lord Flexible Couplings save motors and machines. They increase and improve production. Less noise and less vibration mean better workmen, less fatigue, and result in more work per man-hour.

Into every Lord Flexible Coupling is built the scientific knowledge developed through a generation of pioneering the field of vibration control. The Couplings are made in seven sizes, for any direct drive application, from 1/16 to 1 h.p. Write for Bulletin 200-A.

What Lord Flexible Couplings Will Do for You

1. Absorb torque to approximately 20°, between motor and driven unit.
2. Accommodate angular or parallel misalignment.
3. Prolong the life of bearings, on motor and machine.
4. Reduce installation costs, by eliminating necessity for precise alignment.
5. Absorb the strain of shock loads—starting, stopping, stalling—throughout the assembly.
6. Absorb the force of end and radial thrusts.
7. Provide for even flow of power from motor to unit in work.
8. Reduce noise by eliminating transmission of noise through the shaft.
9. Give protection to the driving motor from suddenly imposed excessive overload.



Every genuine Lord Mounting carries the name "LORD" embossed in the rubber or in raised letters on the forgings.

IT TAKES **BONDED RUBBER** *In Shear* TO ABSORB VIBRATION

LORD MANUFACTURING COMPANY
ERIE, PENNSYLVANIA

SALES REPRESENTATIVES
NEW YORK - - 280 MADISON AVE.
CHICAGO - 520 N. MICHIGAN AVE.
DETROIT - - 7310 WOODWARD AVE.
BURBANK, CAL. - 245 E. OLIVE AVE.
CANADIAN REPRESENTATIVES
RAILWAY & POWER ENGINEERING CORP., LTD.
TORONTO, CANADA

Originators of Shear Type Bonded Rubber Mountings

SPEED CASE

LOW CARBON OPEN HEARTH STEEL

WINS AGAIN

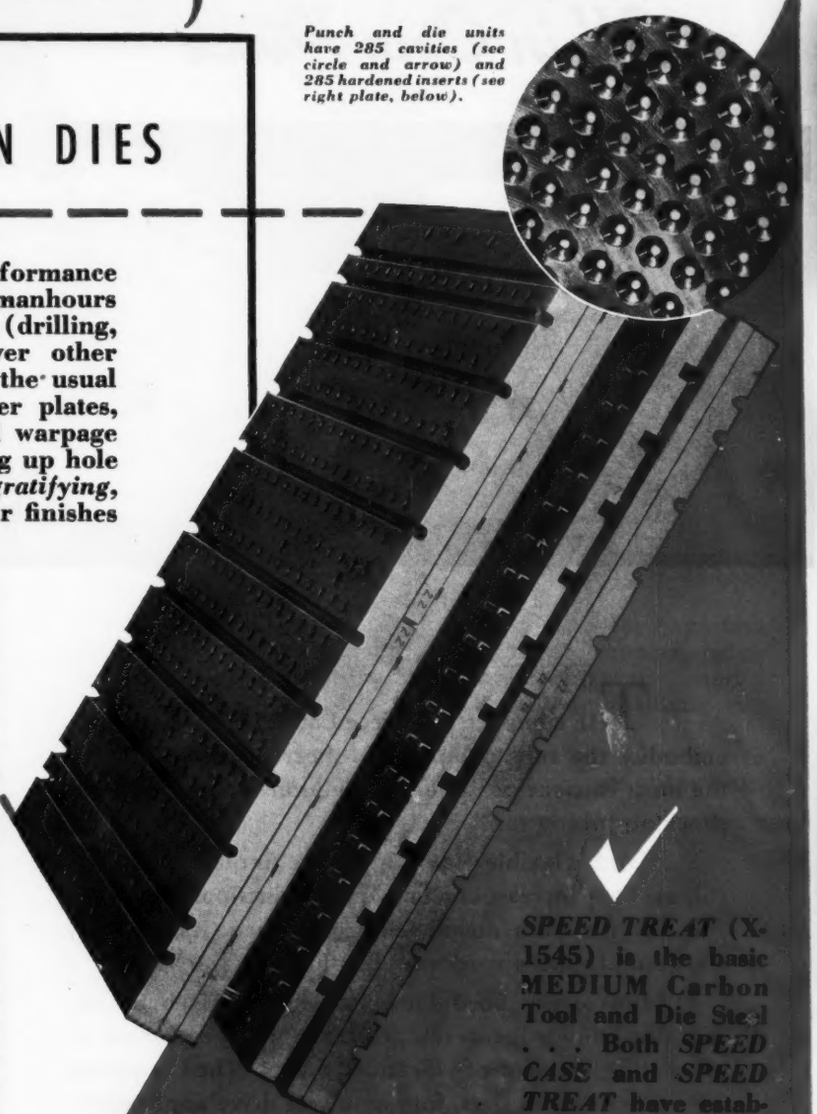
KOPPY-DEKORSE TOOL & DIE CO. DETROIT
Precision Tools & Dies

"We naturally made these plates out of *SPEED CASE* and had absolutely no trouble whatsoever."—
Louis Koppy, President

APPLICATION

PLASTIC BUTTON DIES

Punch and die units have 285 cavities (see circle and arrow) and 285 hardened inserts (see right plate, below).



***SPEED CASE* (X 1520) performance netted a marked reduction in manhours and three times longer tool life (drilling, milling and cavity cutting) over other open hearth steels. Contrary to the usual behavior of mild steel, or boiler plates, these Speed Case plates resisted warpage in carburizing, *all six units* lining up hole for hole when assembled. *Most gratifying*, operators readily obtained mirror finishes on intricate cavities.**

We quote: "These plates were completely machined, including roughing out all holes. Plates were then normalized and we finish-machined from one end to the other. We had excellent success on them, maintaining accuracy, precision and location of holes."

"This plastic button die, of which we built six complete units with universal assembly, was constructed with soft main plates using hardened inserts as punch and die units with carburized and hardened backing plates. We naturally made these plates out of *SPEED CASE* and had absolutely no trouble whatsoever. We are using quite a lot of *SPEED CASE*, we like its machining qualities. It holds up better than ordinary plate for most of the complicated pieces we usually have to work on."

***SPEED TREAT* (X-1545) is the basic MEDIUM Carbon Tool and Die Steel . . . Both *SPEED CASE* and *SPEED TREAT* have established their superiority for machine parts, dies, molds, surface plates, etc.**

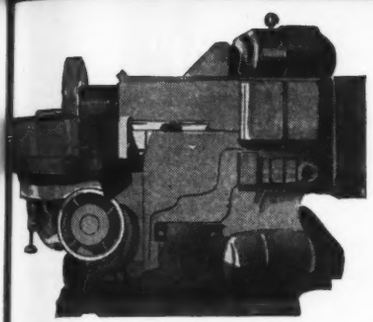
W. J. HOLLIDAY & CO.
"Established 1856"
Hammond and Indianapolis
Speed Case - Speed Treat Plate Division, Hammond, Indiana

***Speed Case* and *Speed Treat* Steel is available in all common plate sizes from these distributors:**

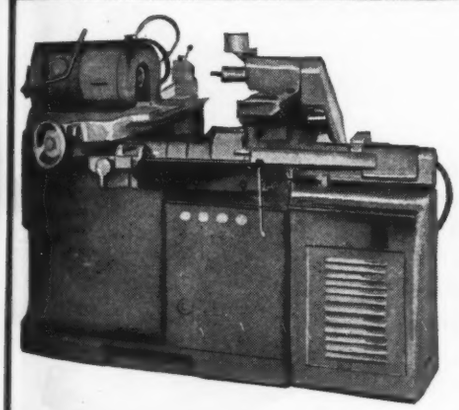
Beals, McCarthy and Rogers, Inc., Buffalo 5, N. Y.
Brown-Wales Co., Boston 10, Mass.
The Burger Iron Company, Akron 1, Ohio
Grammer, Dempsey & Hudson, Inc., Newark 5, N. J.
Peninsular Steel Co., Detroit 7, Mich.
Earle M. Jorgensen Co., Houston 1, Tex.
Los Angeles 54, Calif.
Oakland 7, Calif.
Horace T. Potts Co., Philadelphia 34, Pa.
Peckover's, Ltd., Toronto 2, Ont., Canada

External Cylindrical, Plain. 1730 of these machines with swings from under 6" to 20" are warehoused in the Boston, Chicago, Cleveland, Detroit, Philadelphia, St. Louis and New York areas.

15,996 GRINDERS



M. Horizontal Spindle Surface Grinder. Here is a modern rotary table type machine which can be obtained in Chicago, Cleveland, Detroit and St. Louis in sizes ranging from 12" to 30" table diameters.



H. Internal Cylindrical, Hydraulic Feed. These modern production machines are available in quantity in Cleveland and Detroit and in smaller amounts in other W.A.A. offices. These are precision tools with many applications to post-war production needs.

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

Take your pick of these modern, high-speed tools left over from war. Here by the hundreds are the grinders you need to complete reconversion or finish tooling up for new post-war products. These machines are ready to go to work for you at once. To secure specifications, price and shipping information, simply check the coupon below. Or, if you wish to see the equipment call your nearest W. A. A. office to help you make the necessary arrangements.

SPECIAL GRINDER BUYS!

KEY	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
A	External Cylindrical—Plain	Up to 20" swing	1730
B	External Cylindrical—Universal	Up to 16" swing	347
C	Centerless—Internal and External	All sizes	607
D	Cam		223
E	Crank Pin		83
F	Valve		245
G	Internal Cylindrical—Mech. Feed	All sizes	320
H	Internal Cylindrical—Hydraulic Feed	Up to 42" swing	1094
I	Internal Cylindrical	Under 12" swing	151
J	Internal Cylindrical—Auto Siz. Comb. Hole & Face	16" swing and over	127
K	Internal Cylindrical—Auto Siz. Planetary Type	Under 16" Diam.	39
L	Internal Cylindrical—Auto Siz. Centerless	Up to 28" Diam.	146
M	Surface—Horiz. Spindle Rotary Table	All size table diam.	274
N	Surface—Vertical Single Spindle Rotary Table	12" to 48" Table diam.	157
O	Surface—Reciprocating Horiz. Spindle—Hand Feed	12" length work cap. and over	146
P	Surface—Reciprocating Horiz. Spindle—Power Feed	Under 18" to 120" length work cap.	840
Q	Thread—External only	All sizes	635
R	Thread—External & Internal	3" Cap. and over	82
S	Tool & Cutters	All sizes	691
T	Drill	All sizes	348
U	Single Point Tool	All sizes	458
V	Bench—Double End	All sizes	2876
W	Bench—Single End	Up to 8" Wheel Diam.	1105
X	Floor—Double End—Dry	Up to 24" Wheel Diam.	831
Y	Floor Comb.—Wet & Dry	10" to 16" Wheel Diam.	216
Z	Snag—Swing Frame		155
AA	Comb. Grinder & Buffer		1805
BB	Race Radius—External		118
CC	Race Radius—Internal		72
DD	Contour Profile		75

CHECK AND MAIL TODAY!

To War Assets Administration:*

Without obligation, please send me detailed specifications and price data on the following checked items:

A	G	M	S	Y
B	H	N	T	Z
C	I	O	U	AA
D	J	P	V	BB
E	K	Q	W	CC
F	L	R	X	DD

Grinder check list

Key letters correspond to items shown in list at right. Simply check the key letter of the items in which you are interested.

Name.....Telephone No.....

Firm.....

Address.....

City.....State.....

*For W.A.A. address see 4th page of this advertisement. 27-5

All items shown on these pages are offered subject to prior sale. This surplus property has previously been advertised and offered to prior claimants including Veterans of World War II.

GET

EXPEDITING COUPON **Free Information, Check and Mail Today**

To War Assets Administration*: Please send me specifications, prices and other pertinent information on the items listed below:

(To save writing simply use the key numbers shown in the left hand column of the list at right.)

.....

.....

.....

Name .....Telephone No. .....

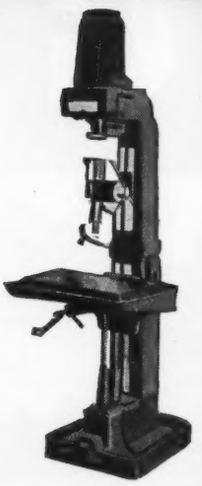
Firm .....

Address .....

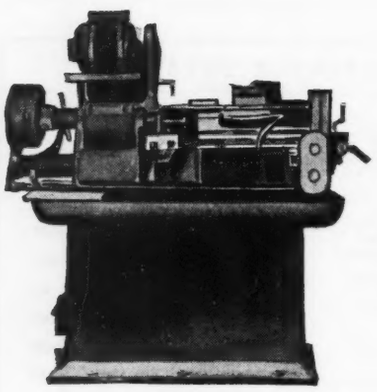
City .....State .....

277-5

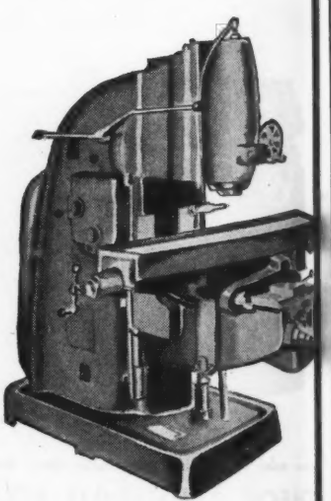
*For W.A.A. addresses see 4th page of this advertisement



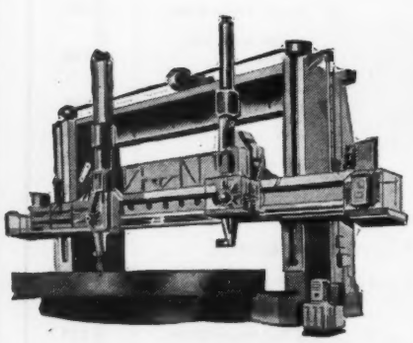
6. and 7. Box Column, Single Spindle Drill. 474 machines of this type with capacity up to 1" and swings up to 24" are in warehouses in Cleveland, Chicago, Detroit, New York, Philadelphia and St. Louis.



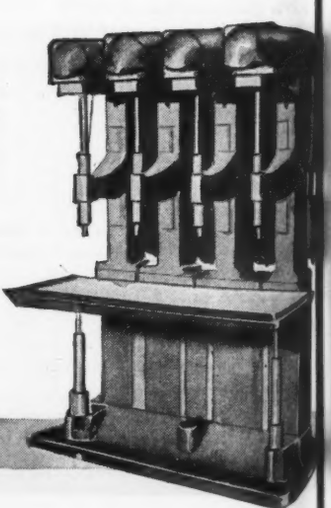
25. Automatic Screw Machine-Bar. This single spindle, indexing turret tool is typical of the 1975 such tools available now in Detroit, Cleveland, Nashville, and Philadelphia.



29. Vertical Universal Miller. In Boston, Chicago, Cleveland, Detroit and New York areas there are 847 of these machines in all sizes and types ready for immediate application.



2. Vertical Boring and Turning Mill. These huge, heavy duty machines may be obtained in sizes from 36" to 120". They are available in all sizes in Detroit and in most sizes in several other W. A. A. offices such as Chicago, Cleveland and Philadelphia.



15. Sensitive Floor & Pedestal Drills — Box Column. There are 3142 of these drills ½" capacity and over, 12" swing and over, located in Detroit, Boston, San Antonio, Denver, St. Louis, Spokane, Cleveland, Chicago and New York.

KEY
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Veterans of World War II—To help you in purchasing surplus property, Veterans' units have been established in each War Assets Administration Regional Office.

THEM NOW!

GOVERNMENT-OWNED SURPLUS MACHINE TOOLS

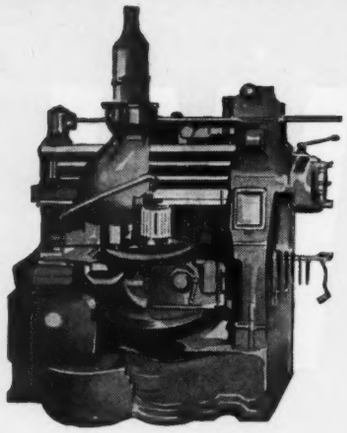
No need to wait for modern production equipment! The tools that won the war can win extra profits for you . . . and do it now! Just look at the hundreds of machine tools shown in this advertisement—all ready for immediate shipment anywhere. For detailed specifications, prices, shipping procedures and location of the equipment simply fill in and mail the coupon at left to your nearest W. A. A. office. Or, if you prefer, call and make arrangements to visit the plants and warehouses where the equipment in which you are interested is stored.

CHECK LIST OF SPECIAL MACHINE TOOL BUYS!

Here are a few of the many hundreds of machine tools available through War Assets Administration.

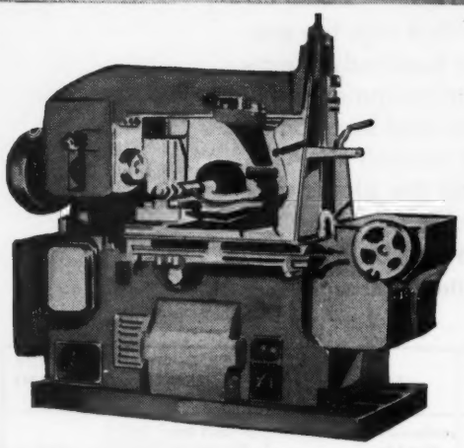
KEY	MACHINE	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
1	Boring, Drilling & Milling	Horizontal	Under 3" to 6"	209
2	Boring & Turning Mills	Vertical	Under 36" to 120" Swing	683
3	Boring & Turning Fixed Rail Mills	Vertical		87
4	Precision Boring Machines	Horiz. bridge—single end	Under 8" to 14"	486
5		Horiz. bridge—double end	Under 8" to 14"	226
6	Drills	Box column—single spindle	Under ½" Cap. Up to 22" Swing	287
7			½" to 1" Cap. 16" to 24" Swing	187
8		Round column—single spindle	Under ½" Cap. Up to 22" Swing	738
9			½" to 1" Cap. 16" to 24" Swing	1163
10		Sensitive Floor & Pedestal Box col.	Under ½" Cap. 12" to 22" Swing	933
11			½" to 1" Cap. 16" to Over 24" Swing	1875
12			1" Cap. and over 24" Swing & over	434
13		Sensitive Floor & Pedestal Round col.	Under ½" Cap. 12" to 22" Swing	384
14			½" to 1" Cap. Under 16" to 24" Swing	1131
15	Drills	Sensitive Floor & Pedestal Upright Type—Box Col.	Up to 28" Swing	549
16		Sensitive Floor & Pedestal Upright Type—Round Col.	Up to 28" Swing	161
17		Heavy Mfg. Type	Up to 32" Swing	296
18		Spec. Kingsbury Way & Vertical		250
19	Multi-Tool	Heavy Duty Mfg. & Production (Not automatic)	Up to 20" Swing	788
20	Lathe	Single Spindle—Horiz. Platten Type		63
21		Single Spindle—Horiz. Turret Type		280
22		Multi Spindle—Horiz. (4-5-6 & 8 spindle)		1518
23		Multi Spindle—Vertical (6 and 8 spindle)		202
24	Chucking Machine	Auto. Between Centers Horiz. Single Spindle	All sizes	2036
25	Screw Machine	Auto—Bar—Single Spindle	Up to 1½" Cap.	1975
		Auto—Bar—5 Spindles	All sizes	1515
26	Screw Machine	Auto—Bar—Eight Spindles	1½" and Over Cap.	380

KEY	MACHINE	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
27	Miller	Horiz.—Plain—Hand Feed	10" and Over Table travel	564
28		Horiz.—Plain—Knee Type	All sizes	2125
29		Vertical—Universal	All sizes	847
30		Automatic	All sizes	455
31		Bed Type—Plain—Horiz. Spindle	All sizes	2703
32		Vertical Spindle—Std.	All sizes	428
33		Vertical Fixed Bed Profiler (1 & 2 Spindle)		847
34		Thread—Universal—Not Automatic	12" and over Work Diam.	76
35		Thread—Universal—Auto.	Up to 20" Cap.	238
36		Thread—Auto.—Chucking		207
37		Planetary	6" to Over 10" Work Diam.	206
38		Spline		248
39	Engravers	Pantograph—2 Dimensions		70
40	Honers	Internal—Horizontal	Under 6" Bore	175
41		Internal—Vertical		129
42	Lapping	Flatsurface only	24" Diam. Lap Plate	107
43	Polishers & Buffers	Floor Type	½ to 10 H.P.	1479
44	Lathes	Speed Type	Up to 3 H.P.	1490
45	Saws	Circular Cut-Off		250
46	Lathes	Cut-Off	Under 1" Bore	136
47	Abrasive Machine	Belt Drum & Disc		580
48	Abrasive Cut-Off			112
49	Tapping	Vertical—1 & 2 Spindle		457
50		Horizontal—1 Spindle		259
51	Die Threading	Bolt Rotary—1 Spindle		390
52	Centering	Double End—Horizontal		112
53	Pointing, Chamfering & Burring			141
54	Shaver	(Not Gear)		104
55	Reamer	(Not Rifle)		516
56	Drawing Machine		100,000# and over	21
57	Machinery & Equipment Allied to Primary Metal Forming Mach. & Equip.	Pickling	All sizes	149
58	Straight Side Presses	Vertical—Single action	5 to 100 Tons	165
59		Vertical—Double action	5 to 100 Tons	111
60	Flame Cutting Machine			1631
61	Hardness Tester	Brinell—Portable & Power		200
62		Rockwell—Manual & Power		425
63	Inspection Machine	Magnetic (Magnaflux)		601
64	Balancing Machine	Static		93
65		Dynamic		67



C. Gear Shaper, External and Internal. Two hundred and eighty of these modern machines are available for immediate delivery in Boston, Chicago, Detroit and New York. Sizes above 25" are to be found in Detroit only.

GEAR CUTTING and FINISHING TOOLS



A. Gear Hobber, Horizontal. These machines, available in Chicago, Houston, Detroit and New York, may be obtained in sizes up to 16" capacity for spur and helical gears and pinions and straight splines.

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

All over America urgently needed production is being held up and profits lost for lack of essential parts—many of them gears. In the W. A. A. warehouses, are 2353 highly productive gear cutting and finishing machines of standard make—ready to go to work immediately to produce needed parts. To see them you need only to contact your nearest W. A. A. Regional Office below—or watch your newspapers for special sale announcements in your locality.

SPECIAL BUYS!

KEY	MACHINE	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
A	Gear Hobber	Horizontal	4" to 16" Cap.	321
B		Vertical—Universal	Under 16" Diam.	89
C	Gear Shapers	External & Internal	Up to 40" Diam.	280
D		Spur—External only		152
E		Spur & Helical—Ext. & Int.	Up to 25" Diam.	275
F		Spur & Helical—Ext. only		159
G		Bevel Type not incl. Plainer Type Str. Bevel	Up to 36" Diam.	377
H	Gear Tooth Finisher	Generating Type Grinding		140
I		Formed Wheel Type		190
J	Gear Tooth Lapper	External only		80
K		Comb. External & Internal		57
L	Gear Tooth Shaver	Rotary Type		133

FREE INFORMATION:

To War Assets Administration:

Please send me specifications and price information on the items checked below:

A	E	I
B	F	J
C	G	K
D	H	L

Key Check List: These Key letters correspond to the items listed in the table at the left. Simply check the key letter for the data you want.

Name..... Telephone No.....

Firm.....

Address.....

City..... State.....

277-5

WAR ASSETS ADMINISTRATION

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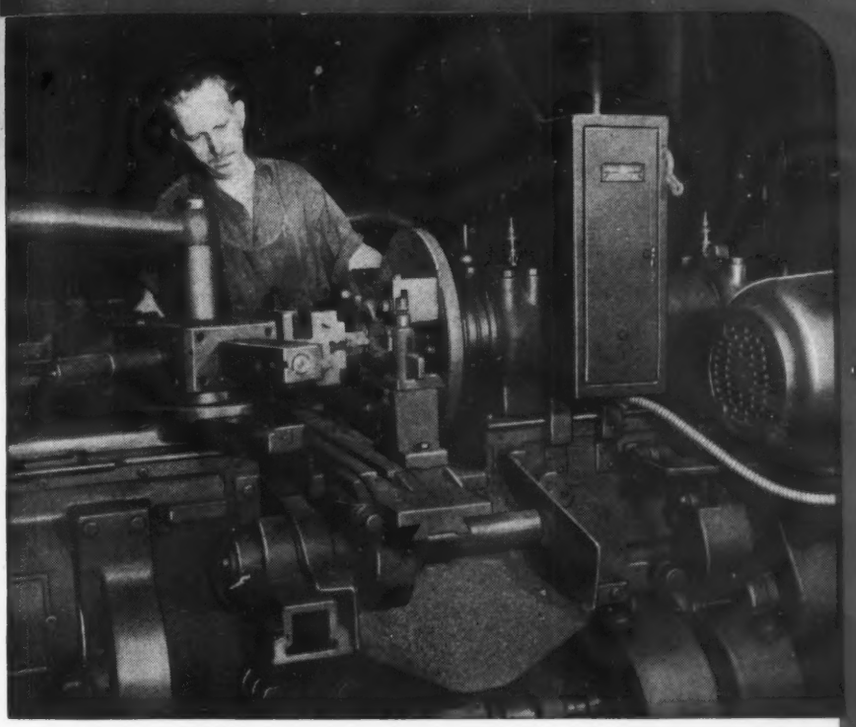
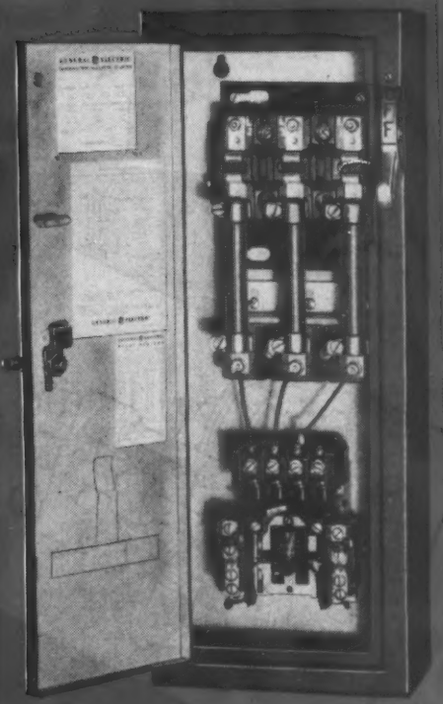
Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver · Detroit · Helena · Houston · Jacksonville Kansas City, Mo. · Little Rock · Los Angeles · Louisville · Minneapolis · Nashville · New Orleans · New York · Oklahoma City Omaha · Philadelphia · Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane · Cincinnati Fort Worth (Telephone 3-5381)

300 G-E COMBINATION MOTOR STARTERS...





...give White Motor Company real protection...save time, money, too.

Magnetic starter and motor-circuit switch in *one* unit—G-E "combination" motor starters of this type give co-ordinated control to over 300 machines in the White Motor Company plant in Cleveland.

The starter shown above is installed on a lathe used in making water pumps. Others control drill presses, shapers, boring mills, grinders, and many other types of machines.

Here's Why the Combination Starter Was Chosen

- Fast-acting overload relays protect the motor controlled from overheating—and fuses protect it from damaging short circuits.
- Safety for operators is assured by interlocking doors. While the power is on, the door cannot be opened.
- Quick servicing and availability of repair parts is made possible by G.E.'s broad network of sales outlets.

Wide Field of Application

This motor company represents just one of the many different industries in which G-E combination starters are at work today. Why not give the advantages of these compact, time-saving starters to *your* plant. Our engineers will be glad to help with your application. Get in touch with our local office today. ***Apparatus Dept., General Electric Company, Schenectady 5, N. Y.***

HOW YOU SAVE...

. . . TIME. Instead of buying two devices, you order and install only one. Mounting time is cut as much as 40 per cent.

. . . SPACE. Compact combination starters can be mounted in small unused places near to or remote from the operator.

. . . MONEY. The list price is slightly more than for two separate devices, but the difference is more than made up by savings in wire, conduit, and fittings.

MORE INFORMATION about combination starters is given in our Bulletin GEA-3715A. Ask our local office for your copy.

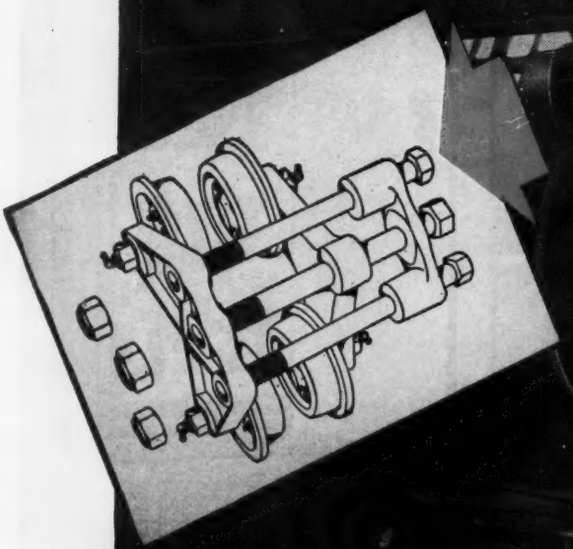
GENERAL ELECTRIC

676-200-8910

Don't overlook the MOVE factor in hoisting..

LIFT

LOWER



We've told you about the lifting and lowering features of our hoists, how the air motor is ideal for hot, gaseous atmosphere—the graduated throttle valve that gives instant and complete control—the automatic safety up-and down-stop—the automatic brake for holding loads, etc. But, we have taken one feature too much for granted and that has been our Articulated Type Trolley.

The trolley provides the MOVE in hoisting. If it is not a smoothly operating trolley, it can account for more than one headache and many minutes lost.

Briefly, here's what we want you to know about the I-R hoist trolley:

1—One bracket is rigid to stabilize the hoist and the other bracket is hinged, thus—
2—The load is always equalized on all four wheels.
3—The spherical wheel treads give one point contact for easy rolling and permit use on beams with flat or sloped flanges.
4—The trolley wheels have a hardened and ground tread and are fitted with—
5—High-grade ball bearings to provide smooth movement.

Our Industrial Air Motor Hoists are available in capacities from 300 to 20,000 pounds. Units can be furnished with a plain or hand-chain-driven trolley (both articulated) in place of the standard top hook. A four-wheel-drive, air-motor-driven trolley is also available.

Write for full particulars on Ingersoll-Rand Air Hoists.

AIR TOOLS
COMPRESSORS
ROCK DRILLS
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PRODUCTION POINTER FOR
JULY 1946
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John Bath and Company, Inc., Worcester, Mass., U. S. A.

BATH GAGES

MAXITORQ FLOATING DISC

1 Overload Release . . . *automatic*

This new design fills a long felt need by manufacturers of high speed automatic machinery which processes breakable or damageable products.

The cam feature permits a most sensitive manual adjustment that instantly releases the clutch at any pre-determined degree of overload . . . an important safety factor in high speed operation. All exclusive features of the standard model (below) are included.

MAXITORQ *Basic Design*

IN 2 OUTSTANDING CLUTCHES

2 Standard Clutch

Floating Discs . . . held apart in neutral by Maxitorq (patented) Separator Springs . . . prevent drag and abrasion . . . there's no heating or excessive wear. "In" and "Out" are positive, controlled with light pressure. NO TOOLS whatsoever are required for assembly, adjustment or take-down.

Specify Maxitorq for sure-action power transmission . . . the last word in compact construction . . . modern design . . . low cost long life operation.

CAPACITIES . . . Standard Type, ¼ to 15 H.P. at 100 R.P.M., Overload Release Type, ¼ to 5 H.P. Used both for continuous shaft and cut-off coupling to connect two shafts.

SEND FOR CATALOG No. M7

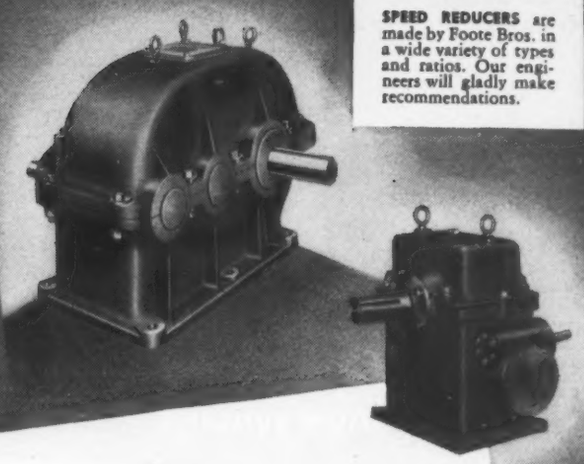
TRADE MAXITORQ MARK

THE CARLYLE JOHNSON MACHINE COMPANY

MANCHESTER CONNECTICUT

"A-Q" (AIRCRAFT QUALITY) **GEARS** approach theoretical perfection. In airplane engines and other equipment, they assure extreme speed and efficiency and compact design.

SPEED REDUCERS are made by Foote Bros. in a wide variety of types and ratios. Our engineers will gladly make recommendations.



NEW WAYS TO SOLVE OLD PROBLEMS

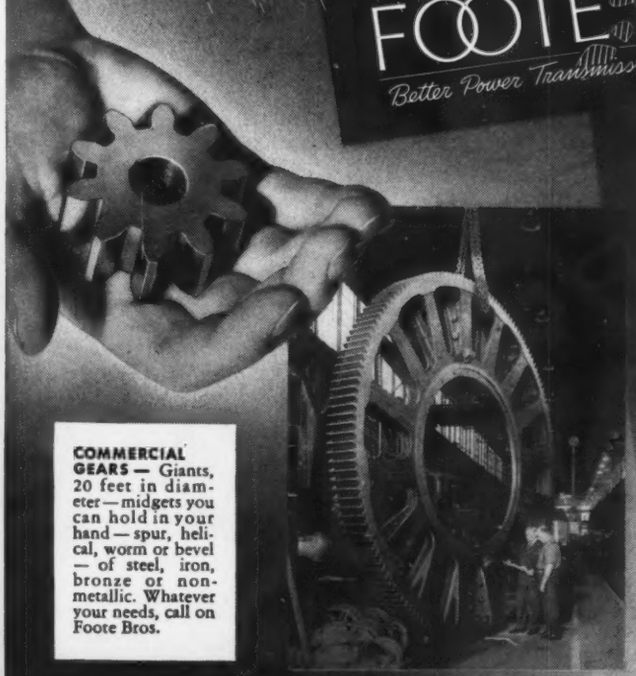
You may have need for a gear 20 feet in diameter to drive a cement kiln. You may face a problem of transmitting power at extremely high speeds—an application that requires gears of laboratory precision. You may need a speed reducer for any one of a thousand applications or a Power Unit to fit a confined space.

Foote Bros. have been specialists in power transmission for nearly a century. During the war, Foote Bros. engineers have done the seemingly impossible both in the production of "A-Q" gears, and Power Units. If your designers are facing any problem in the application of power, let Foote Bros. engineers help them.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago 9, Illinois

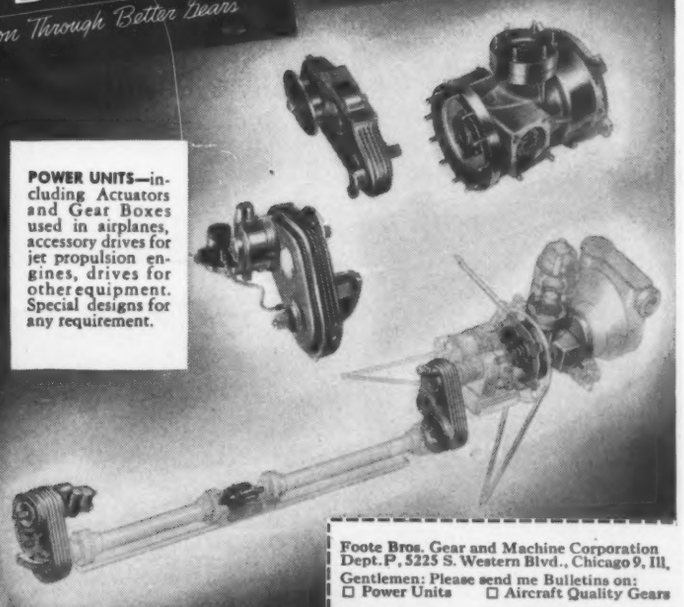
FOOTE BROS.
Better Power Transmission Through Better Gears

Engineering bulletins on "A-Q" Gears and Power Units are sent on request. They offer many new suggestions.



COMMERCIAL GEARS — Giants, 20 feet in diameter—midgets you can hold in your hand—spur, helical, worm or bevel — of steel, iron, bronze or nonmetallic. Whatever your needs, call on Foote Bros.

POWER UNITS—including Actuators and Gear Boxes used in airplanes, accessory drives for jet propulsion engines, drives for other equipment. Special designs for any requirement.



Foote Bros. Gear and Machine Corporation
Dept. P, 5225 S. Western Blvd., Chicago 9, Ill.
Gentlemen: Please send me Bulletins on:
☐ Power Units ☐ Aircraft Quality Gears

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Firm _____
Address _____
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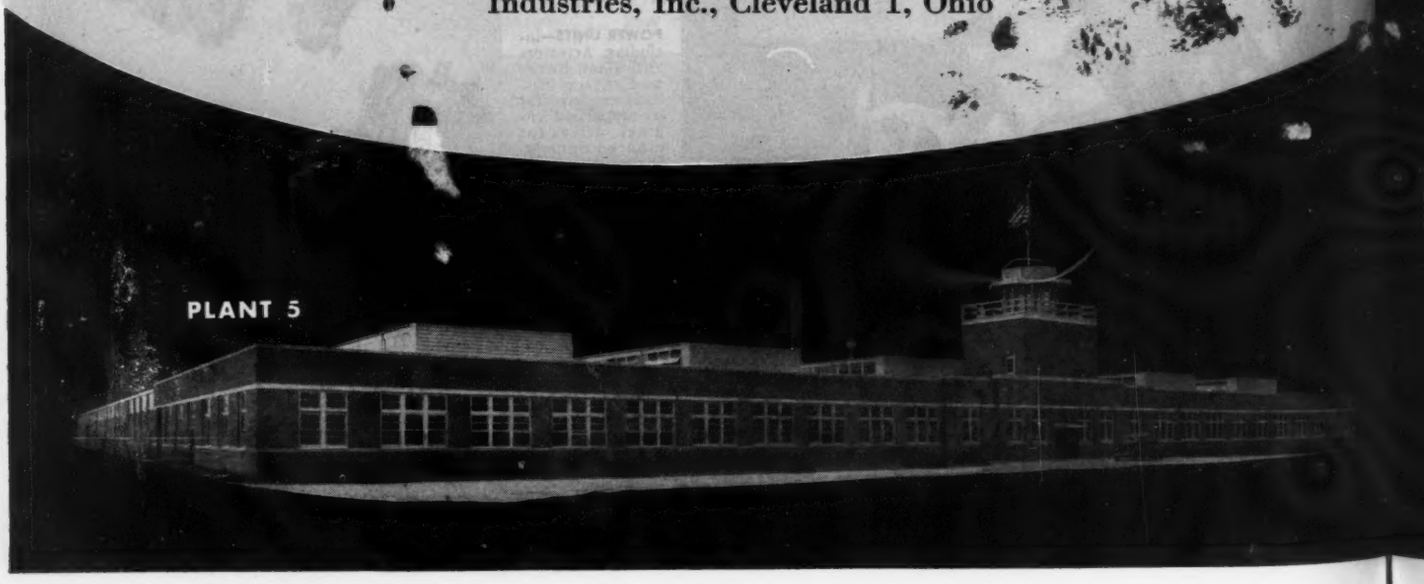
Jack & Heintz builds for the Future

These are the eight modern buildings of Jack & Heintz Precision Industries, Inc. But the important part of Jack & Heintz can't be shown in any picture—it is the engineering precision, the manufacturing skill that enabled these eight plants to turn out millions of precision products at production-line speed and economy. These same qualities are evident today in Jack & Heintz motors, magnetos, bearings, starters, generators and gauges. And they will mark the new products this company will soon announce. Jack & Heintz Precision Industries, Inc., Cleveland 1, Ohio



PLANT 4
PLANT 7
PLANT 6
PLANT 3
PLANT 2
Jack & Heintz
PRECISION INDUSTRIES, INC.
JAHCO

DESIGN ENGINEERS with foresight

Create Compact Designs

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SOCKET SCREWS

WRENCHING

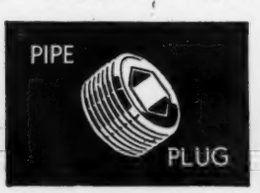
The Internal Wrenching feature permits the saving of Weight - size of members reduced. . . Saving of Space - minimum clearance for internal wrenching plus fastening placed at desired location. . . . Saving of Assembly Time - quick and positive tightening increases speed of assembly.

Holo-Krome Socket Screw Products are scientifically heat treated to develop, in their correct proportion, the various physical properties inherent in the special analysis alloy steel used in the manufacture of Holo-Krome FIBRO FORGED Screws - the Completely Cold Forged Screws.

Your Holo-Krome Industrial Distributor is ready to serve you from his warehouse stock.

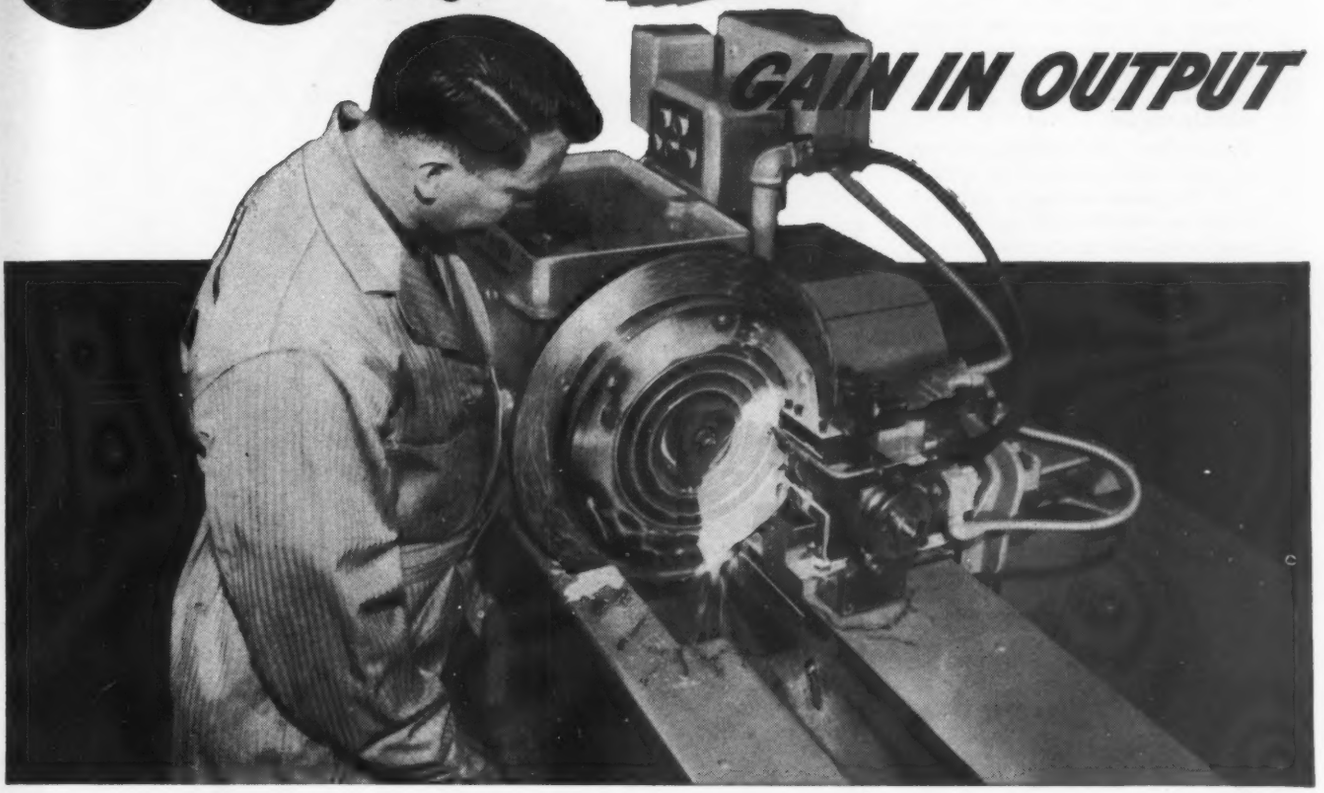
GUARANTEED *Unfailing PERFORMANCE*

THE HOLO-KROME SCREW CORP. HARTFORD 10, CONN., U. S. A.



66% Extra

GAIN IN OUTPUT



. . . when this automatic lathe was THY-MO-TROL equipped

Here's another striking example of the production gains that can result from the partnership of a modern automatic tool and G-E Thy-mo-trol drive.

To speed the cutting of a groove (0.065 in. wide, 0.070 in. deep) on a cartridge reel, a metal-working plant first shifted the work from an older type machine to a modern Sundstrand automatic lathe with special tooling. As then equipped with a two-speed, 2-to-1 ratio motor drive, the output rate of the new lathe was three per hour.

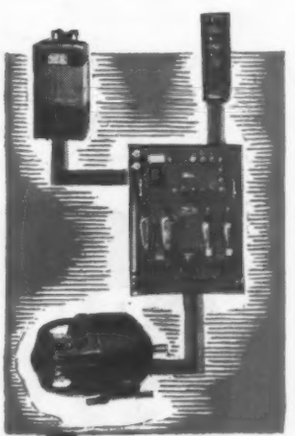
Later, with a change to electronic, stepless speed control of the lathe instead of the two-speed drive, an increase to five pieces per hour was obtained—a 66 per cent *extra* gain, thanks entirely to Thy-mo-trol.

Develops Full Potential of Good Tools

On new machines which are the pride of leading machine-tool designers, G-E Thy-mo-trol drive gives the precision control of speed and torque that's needed to get the most out of all the other advanced features. It provides rapid, controlled-current acceleration and dynamic braking. Speeds can be preset on a small dial that's part of the push-button station. Yet the drive operates from an ordinary a-c power source.

A Complete Drive

Standard Thy-mo-trol drives are available from 1/8 to 25 horsepower. And larger sizes can be furnished. Four compact units—d-c motor, electronic panel, power transformer, and control station—make up the complete drive. For full information, call your local G-E representative. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



GENERAL ELECTRIC

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IDENTICAL TWINS FOR TOP PERFORMANCE

You'll find Bay State Portable Snagging Wheels as alike in performance as in appearance. That's because Bay State makes them as nearly identical as grinding wheels can be.

You can be certain that the faster, cleaner stock-removing action and increased economy you get from one Bay State Wheel will be duplicated in every other made to the same specifications. Try the popular sizes 6x1x⅝ — 8x1x⅝ or Bay State Cones, and prove this to your own satisfaction. They're all cooler cutting, longer lasting — thanks to Bay State's special resinoid and vitrified bonds.

There's a bulletin with full details on Bay State Snagging Wheels. Write for it today.

BAY STATE ABRASIVE PRODUCTS CO.

3 Union Street, Westboro, Mass.

GRINDING WHEELS

HONING AND SUPERFINISHING STONES

PORTABLE SNAGGING WHEELS

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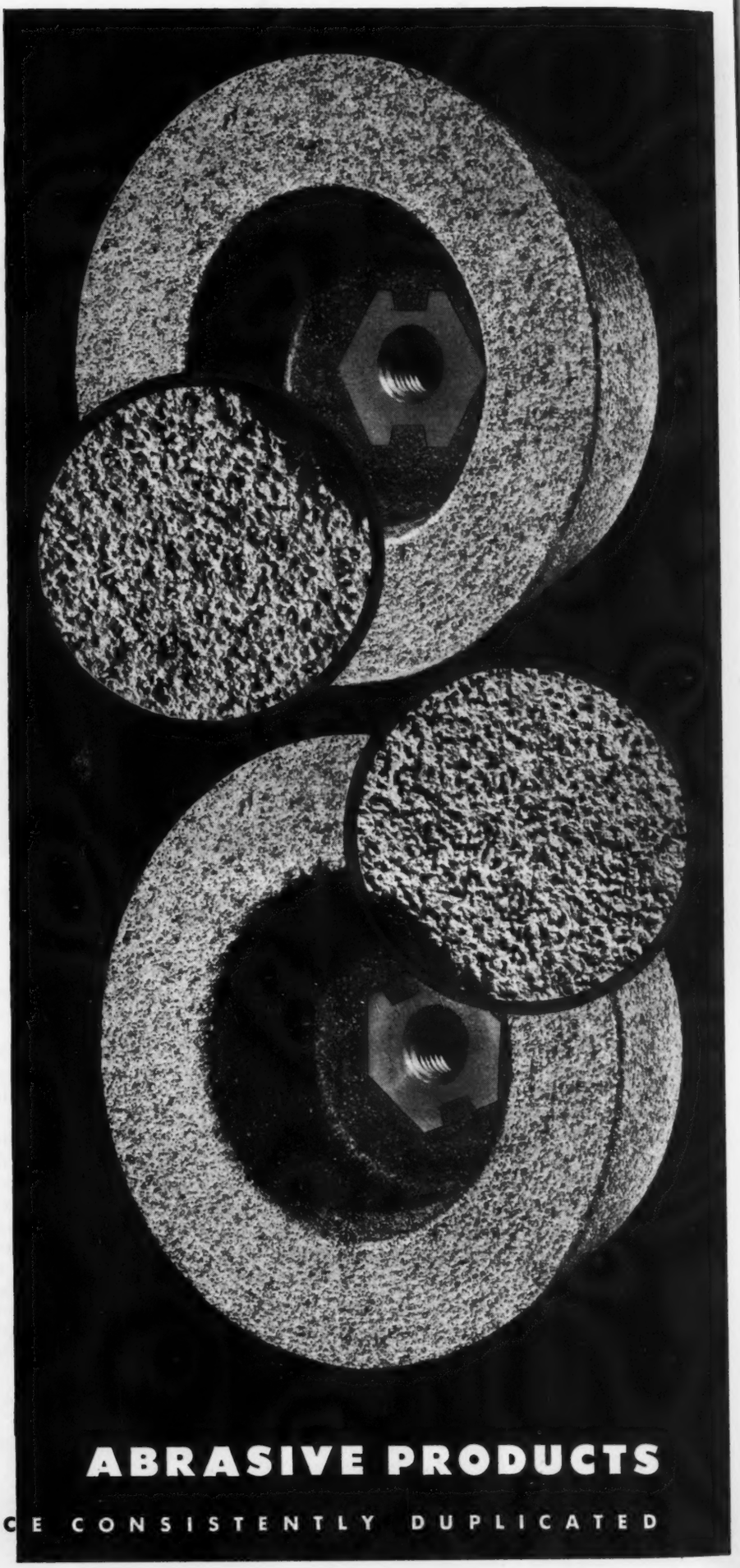


BAY STATE

TOP PERFORMANCE CONSISTENTLY DUPLICATED

A PRODUCT OF
B-W
BORG-WARNER

These shock-absorbing Neoprene "muscles" take the rap!

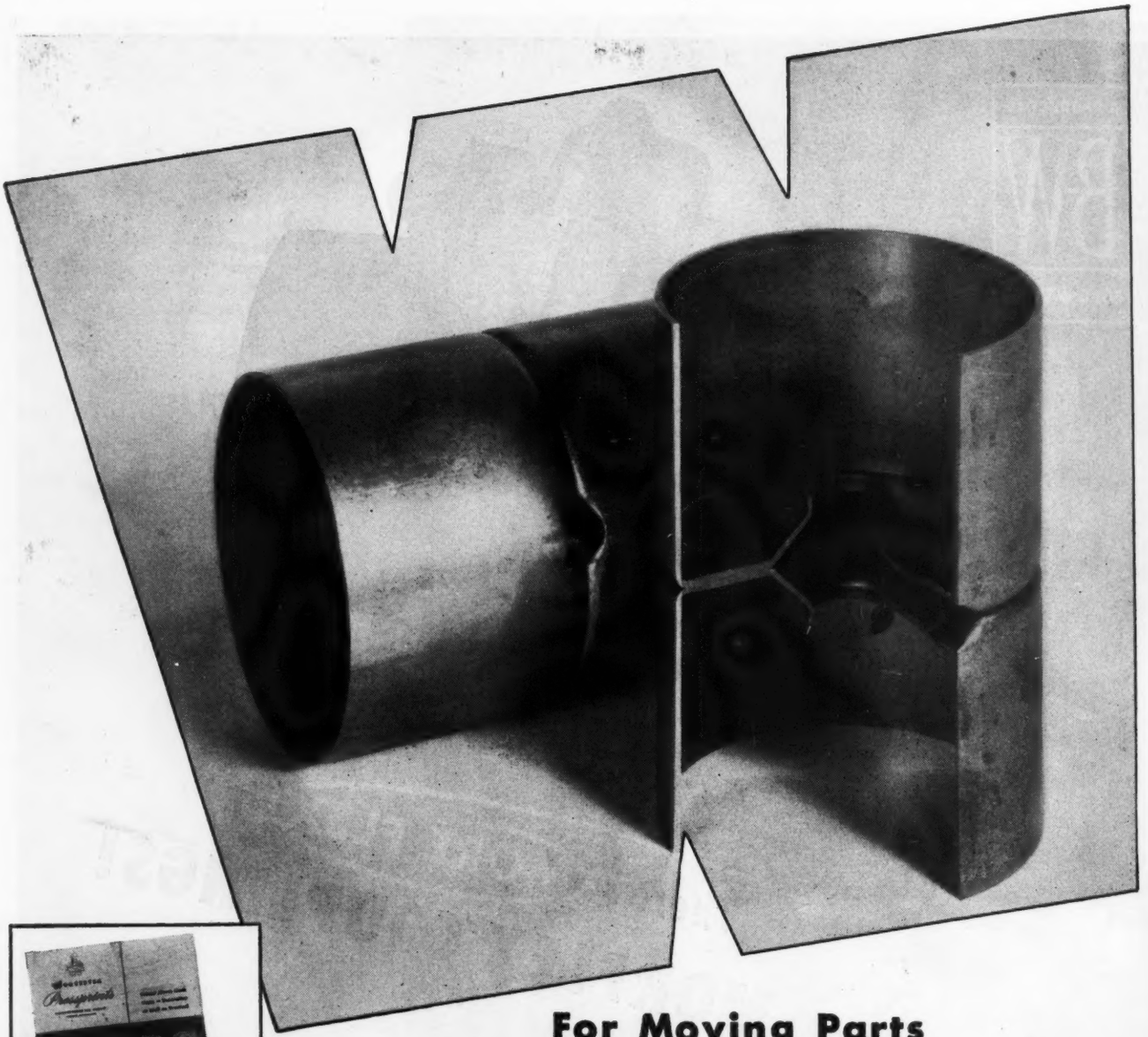
The Neoprene biscuit assembly is an exclusively Morse-designed feature. No metal-to-metal contact; bearing wear reduced. Shock, uneven impulses and vibration are absorbed. Positive, direct drive is permitted in a Morflex Coupling installation.

The *single* Morflex handles shaft misalignment up to 5°; the *double* Morflex handles extreme misalignment. There is a Morflex Coupling to fit your needs and cost requirements . . . and available in quantity!

Address our Detroit office for complete information.

MORSE CHAIN COMPANY, DETROIT 8, MICHIGAN • ITHACA, NEW YORK

MORSE ROLLER and SILENT CHAINS
SPROCKETS • FLEXIBLE COUPLINGS • CLUTCHES



Are you receiving Pressprints? We will be glad to put you on the mailing list.

For Moving Parts
Presteel Stampings Get First Call

Lighter, stronger take-up rolls (idler pulleys) are demanded by the users of Fletcher Works textile machinery. To turn at high speeds, these welded stamping assemblies are made to close tolerances, are better balanced, require no machining except for tapping the set-screw hole. Lighter, they save waste energy and power; stronger, they provide better impact strength and longer life. For moving parts, *Presteel* stampings of different metals and alloys offer definite advantages and many possibilities. Let us study your parts problems. Redesign for stamping may solve many of them. You take no chances when you specify *Presteel*.

WORCESTER PRESSED STEEL CO.

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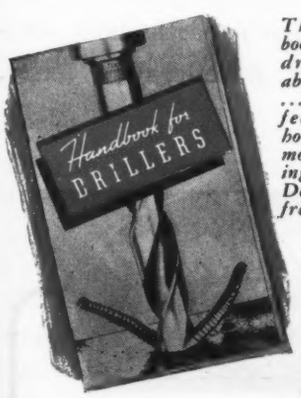
CLE-FORGE HIGH SPEED DRILLS

TRADE MARK REG U.S. PAT. OFF

. . your assurance of

HIGH QUALITY PERFORMANCE *at* LOW COST

Experienced machinists choose the tool that does the job *quicker* and *better.* Experience has taught them that CLE-FORGE High Speed Drills are not only the most satisfactory on every count, but actually cost less per hole. You cannot buy better drills . . . and no drills will give you lower costs.



This illustrated booklet answers hundreds of questions about Twist Drills . . . grinding, correct feeds and speeds, how to correct common errors in drilling, etc. Write to Dept. E for your free copy.

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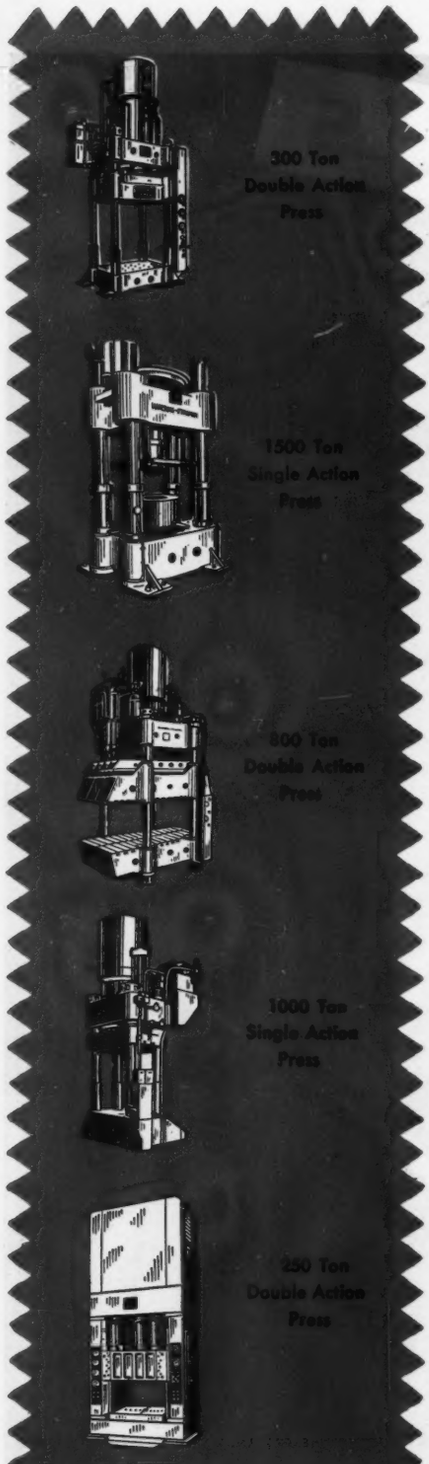

HYDRAULIC PRESSES for METAL-FORMING

200 Ton Single Action Press

HIGH SPEED, extreme flexibility and versatility—are reasons why metal-forming "The Hydraulic Way" is the *better* way.

Note this sturdy, compact 200-Ton Watson-Stillman high speed Single Action Forming Press. Watson-Stillman adjustable, automatic speed control makes impact forces practically negligible. Uniform results are guaranteed by automatic press reversal at a positive predetermined pressure which can be secured at any point within the press stroke... Press and dies cannot become overloaded, for it is impossible to exceed the pressure setting of this Watson-Stillman press.

Watson-Stillman has been building rugged, dependable equipment for ninety-eight years. Combined with this experience is the most modern engineering skill obtainable in the industry. If you have a metal-forming problem that is particularly intricate, write or call Watson-Stillman Co., Roselle, New Jersey.

1285

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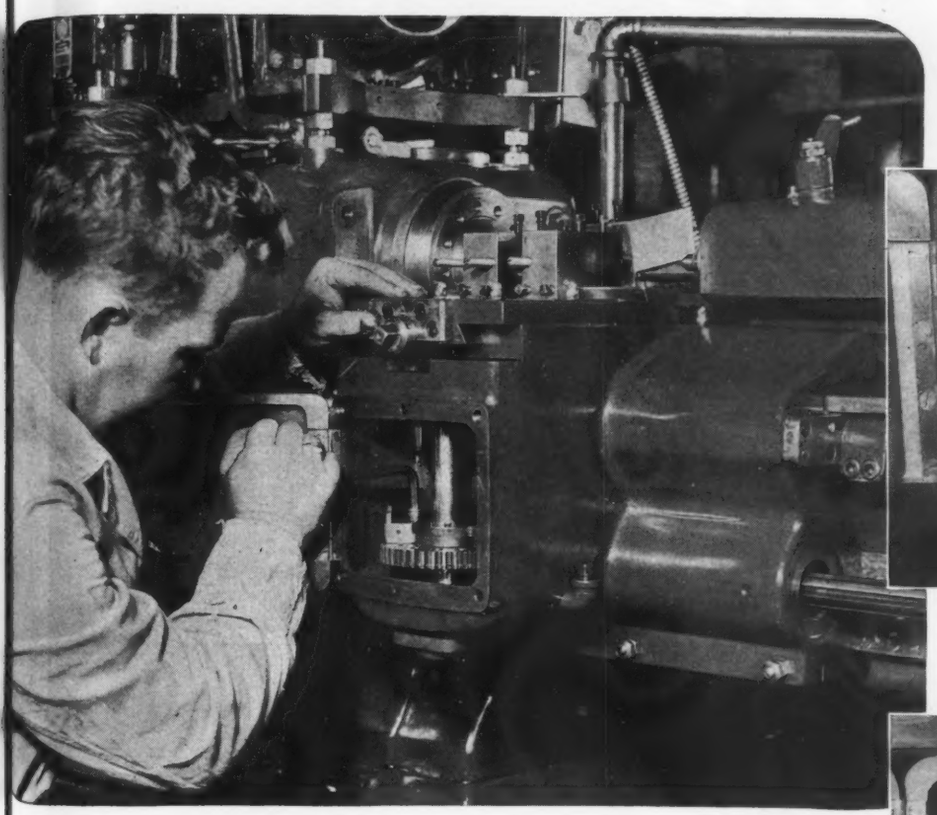
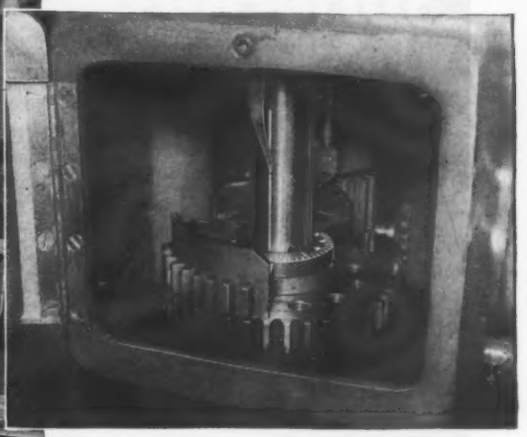
MANUFACTURERS OF THE MOST COMPLETE LINE OF HYDRAULIC MACHINERY

MACHINE OF THE MONTH

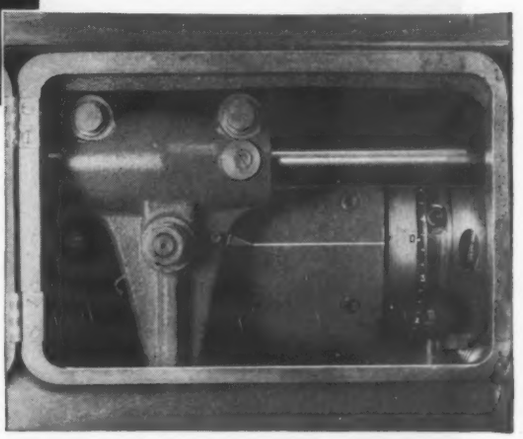
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



Close-up view of Simplified Change-Over Mechanism.



Close-up view of drum cam showing index line and graduated adjustment ring.



ALL Lo-swing AUTOMATIC LATHES PROVIDE FOR SIMPLE CHANGE-OVER FROM JOB TO JOB

Production men appreciate the speed and simplicity with which all automatic Lo-swing Lathes can be changed-over from job to job. A hinged door on the Model "LR" provides easy access to the Simplified Change-Over Mechanism located on carriage front. Simply loosen two cap screws and move gear segment to graduation on scale corresponding to desired length of cut in inches. Tighten cap screws, and carriage is timed for the job at hand. Cam is standard and does not have to be changed, and since the cycle is closed and locked, machine cannot get out of time.

Rapid traverse adjustment is accomplished with equal ease and speed thru the hinged door at the head end of machine. Loosen two cap screws and slide the ring which is graduated in inches around until the length of cut desired in inches is opposite the zero mark. This automatically positions the rapid traverse control cams so that the remainder of the cycle is completed in rapid traverse. A Rapid Traverse Control Handle, conveniently located just below the door opening, further facilitates this adjustment and reduces change-over time.

All Lo-swing Automatic Lathes now have this Simplified Change-Over Mechanism as an inbuilt feature.

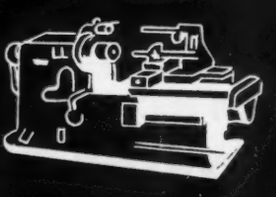
SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

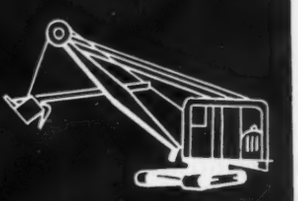
LATHE NEWS from SENECA FALLS

McGILL

SOLIDEND MULTIROL Bearings

Designed as a self-contained unit, with races and rollers made from through-hardened high-carbon chrome steel, there are no loose parts to warp or break. The solidend shoulder construction and retaining lip, built integral with the outer race, hold the rollers, eliminating any possibility of the bearing coming apart during installation or operation. Rounded end, full length rollers give greater load carrying capacity, and close tolerance in construction, increases the overall efficiency. Where it is necessary to conserve radial space the bearing can be used without the inner race and the bearing mounted directly on the shaft. Provision for incidental thrust is provided along with adequate lubrication facilities. Write for Bulletin SM-42. If you have a special bearing problem McGill engineers will be glad to cooperate in working out a bearing to fit.

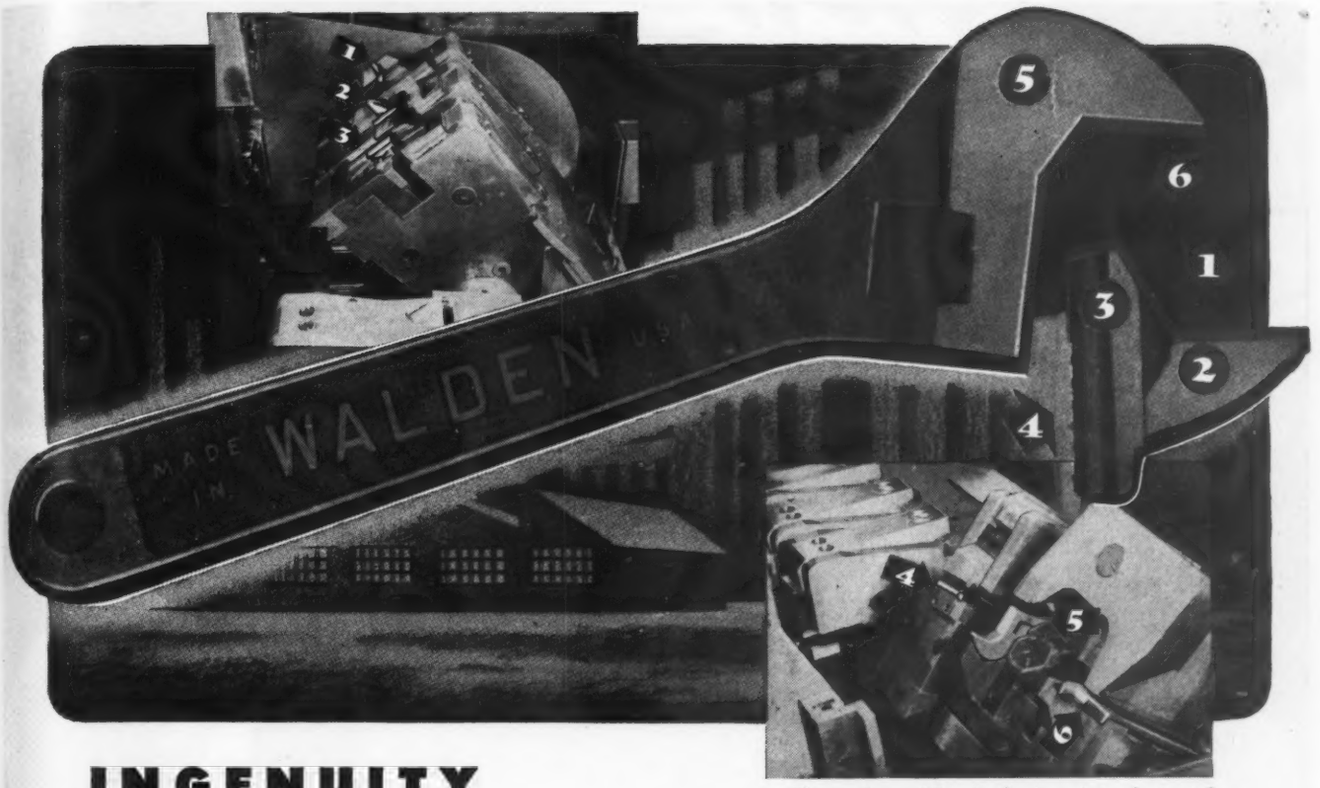




FOR ALL TYPES OF INDUSTRIAL EQUIPMENT

McGILL MANUFACTURING CO., INC.

MANUFACTURERS OF BALL AND ROLLER BEARINGS — VALPARAISO, INDIANA



INGENUITY UNLIMITED!

Shown in position in the Lapointe designed fixture are the six broached surfaces finished in one cycle of the double ram machine.

The effectiveness of the broaching process is limited only by the ingenuity of the men who design the required fixtures. Lapointe, pioneers in the art of broaching, has met this challenge innumerable times.

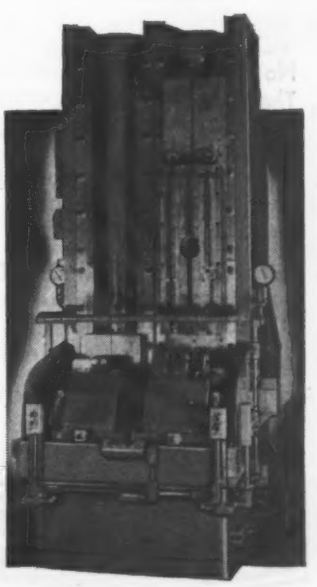
For the mass production of parts of this Stevens-Walden wrench a unique fixture was created which permits six separate broaching operations being performed in one cycle of a double ram machine.

The fixture in this case requires only unloading and reloading while cycling. The clamping of each part for each of the six operations is entirely automatic which does away with fatigue and soon pays for itself in increased output.

From this multiple operation on steel forgings to the precision broaching of Van Norman boring bars represents a wide range of flexibility.

Yet as diverse as are these demands Lapointe designed broaches and fixtures performed to perfection in each assignment.

Perhaps in your plant there are possibilities for this pliant process. Write to The Lapointe Machine Tool Company today for full information.



Lapointe 15-ton 66" Vertical Double Ram Machine with Special Attachments.

THE Lapointe MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

THE LATHE THAT ACCOMMODATES ITSELF TO *Your* REQUIREMENTS

No complicated features. No "unwanted" equipment! The Oster No. 601 *"RAPIDUCTION"* screw machine can be furnished as *YOU* want it! For example:

Either with 4-speed motor (which permits four speed changes without change of sheaves) or with the 2-speed motor.

Either with WORM DRIVE (for smooth, adequate power required to make heavy forming cuts) or with DIRECT DRIVE (for high spindle speeds on small diameters and on non-ferrous metals).

Either with automatically indexed, 6-position turret (for two or more operations in sequence) or with plain saddle and single tool post.

Automatic chuck capacity is 1½" round bar. Swing over bed is 14"; over cross slide 6½".

Motor is mounted in oil-resistant rubber for smooth, quiet operation. Individual ⅛ H. P. motor operates coolant pump to insure uniform flow of lubricant independent of spindle speeds. Electrical controls have speed selector switch located conveniently for the operator.

Write for Catalog *"List No. 27-B"*.

OSTER

THE OSTER MANUFACTURING COMPANY
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No. 601 *Rapiduction* LATHE

Warco PRESSES

The Finest Line of
WELDED STEEL PRESSES
Weldments fully stress-relieved

Don't Let Delayed Delivery Hold Up Your Program

If getting prompt delivery of a new press is holding up your production program, you will be interested in how Warco is helping scores of metal fabricators.

Exceptionally large engineering and production facilities enable us to deliver the press you need much sooner than many other manufacturers.

Warco presses are the most modern welded steel presses made, offering advantages that experience has shown are most desired by press users. They're engineered specifically for greater rigidity, accuracy, strength, power and endurance.

Warco's experienced press builders give personal attention to your specialized problems. Your inquiry will receive prompt attention. We invite you to inspect our plant, the largest of its kind in the world.

OBI MODELS

Warco open back inclinable presses are especially suited to all light work. Capacity range from 50 to 200 tons, stroke range from four to 14 inches. Single-geared, electrically controlled, with latest type of friction clutch and brake unit.

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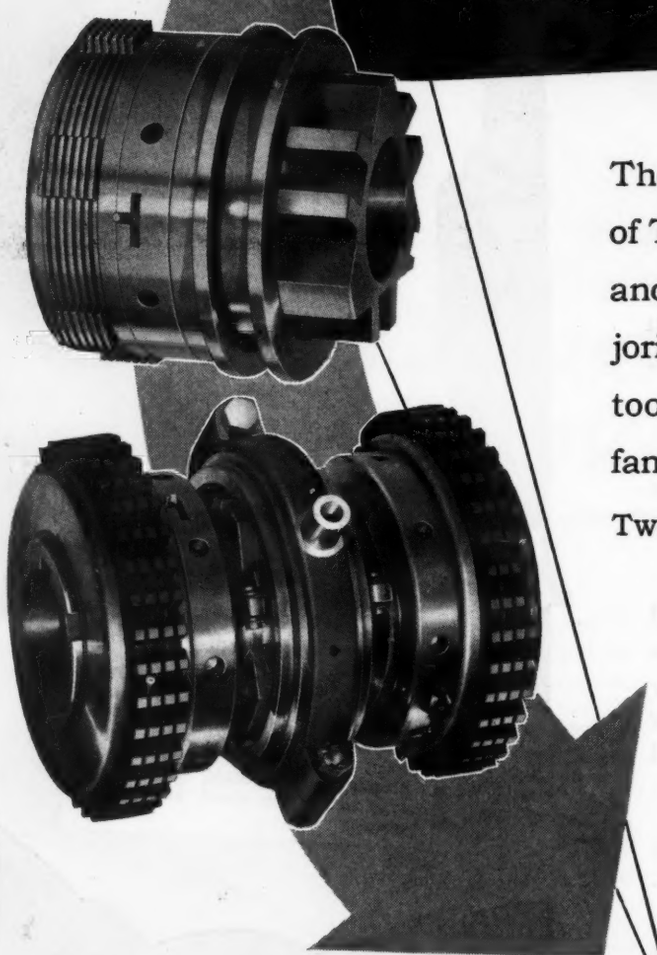
A subsidiary of The Federal Machine and Welder Company . . . Offices in Principal Cities

ECCENTRIC GEAR PRESSES • HYDRAULIC PRESSES • PRESS BRAKES

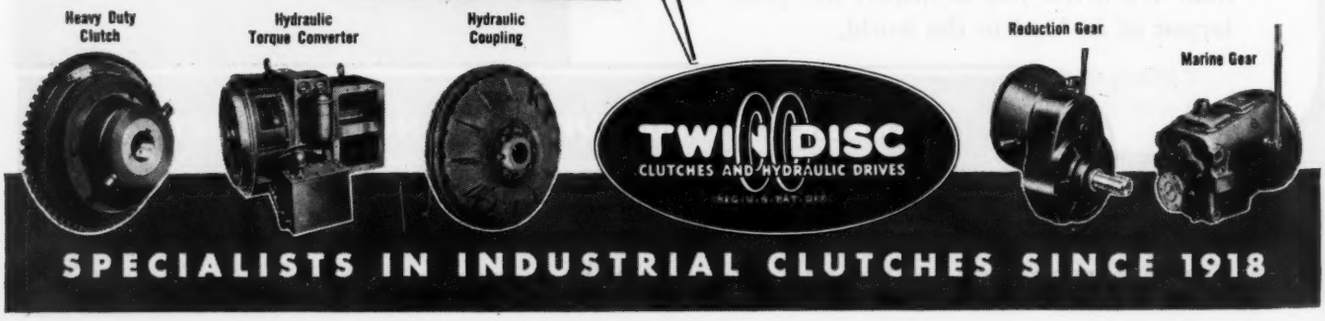
1 Compact Design
2 High Torque Capacity
3 Long Wear-life



These three essentials are part and parcel of Twin Disc Machine Tool Clutch design and performance. That's why—on a majority of the nation's best known machine tools—the Twin Disc name plate is a familiar and respected sign.

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin
(Hydraulic Division, Rockford, Illinois)

Twin Disc Model MTS (single, oil type—illustrated at left, above) and Model MTU (duplex, dry type—illustrated at left, below) Machine Tool Clutches are furnished either to run dry or in oil. In either type, clutch design assures ease of operation. Single-point adjustment is provided to obtain as close as .003″ adjustment in all sizes.



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

Check these Main Points

WHEN YOU'RE MACHINING STAINLESS STEEL

Have you a copy of the Allegheny Ludlum "Fabrication Blue Sheet"?

Contains a wealth of reliable, certified data, not only on the machining of Allegheny Metal, but on the best methods employed in other fabrication operations on stainless steel—forming, welding, finishing, etc. Write for your copy—you'll find it highly useful and complete.

ADDRESS DEPT. M-43.

COME war or peace, stainless will always be a critical material *in the shop.* You'll want to keep rejects and spoilage low, as well as machining time and cost—and there are ways to do it.

Cutting speeds can't be as fast as with carbon steel or low alloys. Tools should be high speed steel or carbide-metal tipped, with a generous rake and a chip breaker, if possible. Keep them sharp, and don't allow the tool to ride on the work, to avoid work-hardening.

More important, check the design of the cutting tool itself, and check the possibility of using one of the special easy-machining grades of Allegheny Metal. Let us help you also to select the right cutting tool from our complete range of High Speed Steels, ALX Cast Alloy Bits and Carmet Carbide Tools.

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STEEL CORPORATION
General Offices
Pittsburgh 22, Pennsylvania

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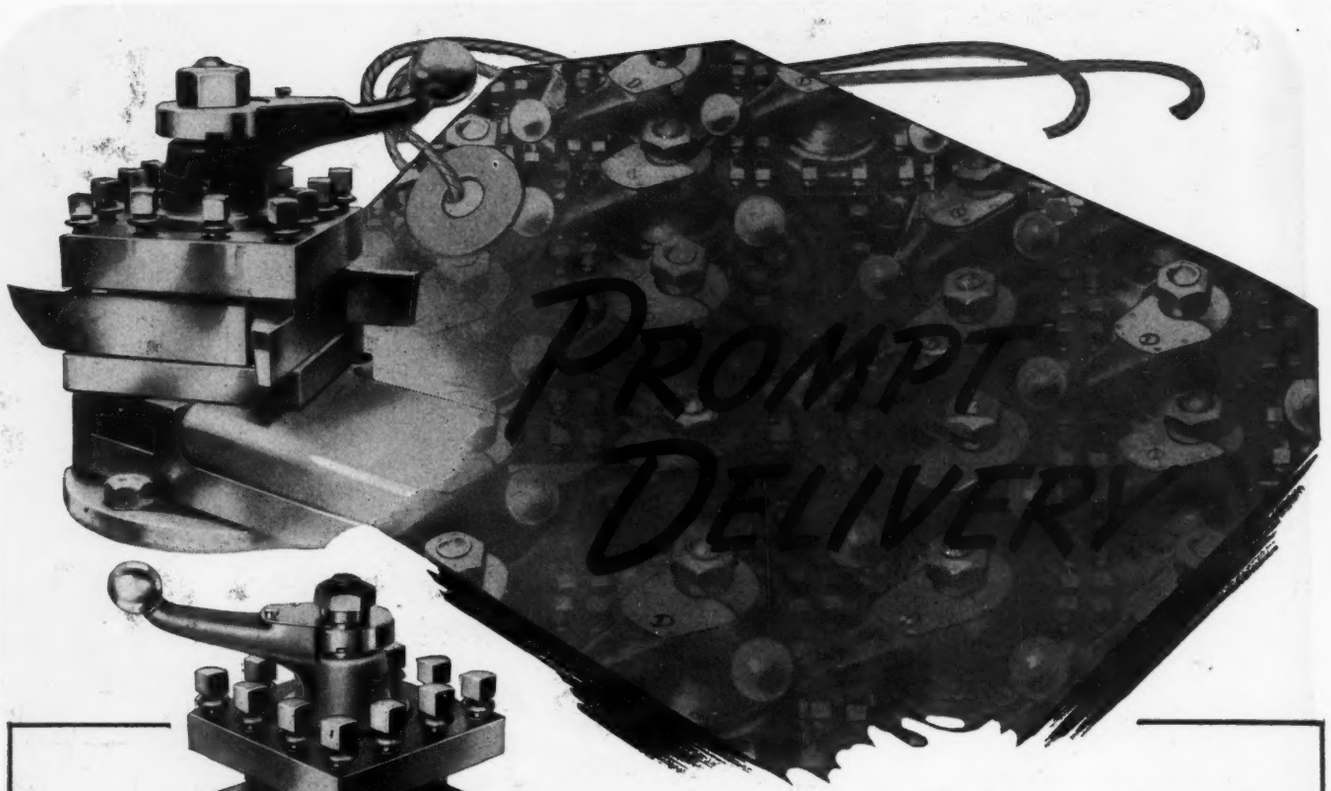
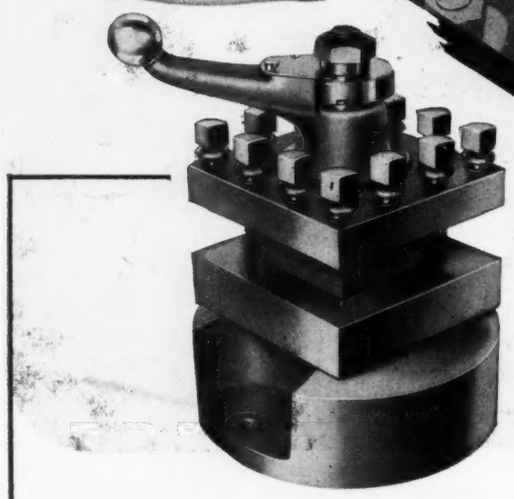
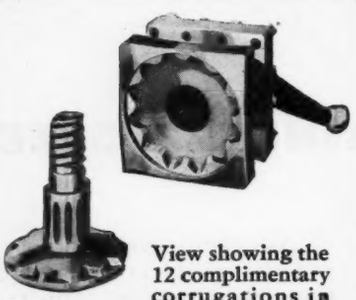
Branch Offices in Principal Cities . . . Allegheny Metal also handled by all Joseph T. Ryerson & Sons, Inc. Warehouses





# of McCROSKY *Turret* TOOL POSTS



View showing the 12 complimentary corrugations in the turret column and body—an exclusive McCrosky feature—that assures accurate indexing to extremely close limits and provides the rigidity needed for heavy cuts.

● Featuring a service proved design, conceived, perfected, and available only from McCrosky, TURRET Tool Posts permit successive tools to be swung into cutting position easily, quickly, and accurately, without stopping the machine for tool changes. They speed up production, and give engine lathes the versatility of turret lathes. The indexing corrugations on the post and body with their long shore line of contact are finished to extremely close tolerance on specially built machines. This construction provides the extreme rigidity needed to withstand the thrust of the cut—minimizes wear—and assures accurate indexing within the close limits required for repetitive work.

McCrosky TURRET Tool Posts are endorsed by all well known lathe manufacturers,— and are used extensively by leading concerns from coast to coast. Furnished in five styles including square and hexagon designs,— nine different sizes. Write for Bulletin No. 16-E. It gives full details.

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

COST CUTTING TOOLS

Designers and Manufacturers of

Jack-Lock Milling Cutters — *Super Adjustable* Reamers

Block Type Boring Bars — *Turret* Tool Posts

Wizard Quick-Change Chucks — *Special* Multiple Operation Tools

STRAIGHT AND *TRUE*....

... FOR HIGH-PRODUCTION PRECISION DEEP HOLE DRILLING

The Pratt & Whitney Multiple Spindle Vertical Deep Hole Driller performs a variety of high-production precision drilling jobs with speed and accuracy. It can handle drilling operations on a wide diversity of products from rifle and pistol barrels, sewing machine components, connecting rods, and boiler stay-bolts to aircraft engine valves.

The standard vertical driller has a drilling range diameter from 3/16" to ⅝"; a maximum drilling length of 12"; nominal spindle speeds of 900-3000 rpm.; and nominal feeds from ¾" to 2" per minute ... plus many built-in features including controlled high-pressure coolant; force-feed lubrication; automatic power knock-off and return of the work slides at the completion of the drilling.

Flexible ... adaptable ... easily operated. The vertical driller is geared to modern mass-production requirements.

Write on your firm letterhead for further information to the address below.

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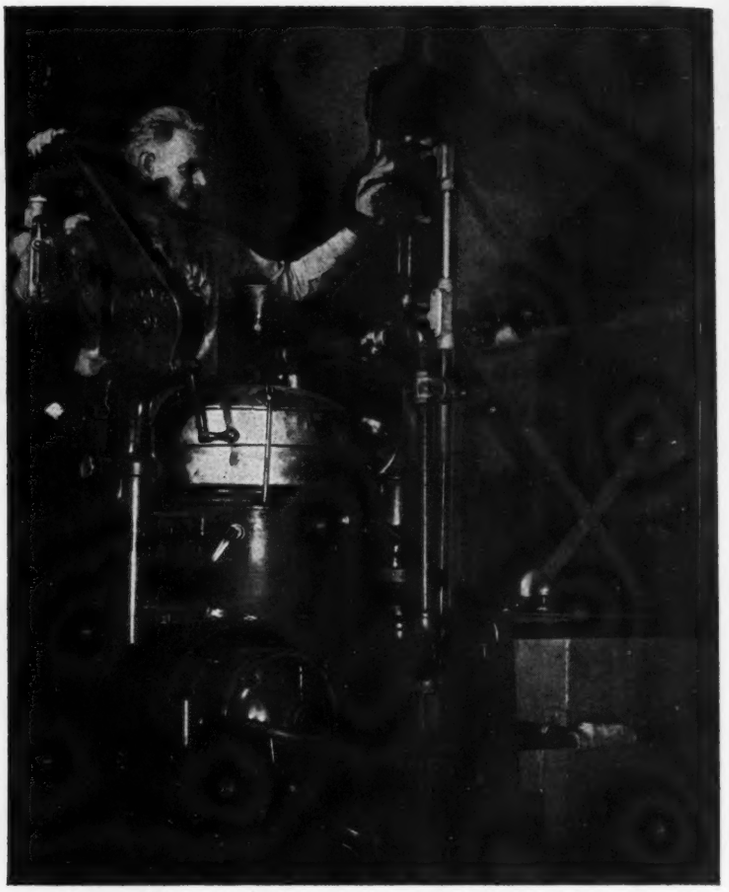
COLLECT THE DIVIDENDS THAT Clean Oil BRINGS...



A Few Applications for DE LAVAL Oil Purifiers in Metal-Working Plants

BALER OIL	HYDRAULIC OIL
BORING OIL	LUBRICATING OIL
BRIQUETTING OIL	MOTOR BLOCK TEST OIL
CABLE OIL	QUENCHING OIL
CUTTING OIL	RECOIL OIL
DRAWING OIL	SHOCK ABSORBER OIL
ENGINE OIL	SLUSHING OIL
GRINDING COOLANT	TRANSMISSION OIL
HONING OIL	WASHING OIL

...*and in the Power Plant*

LUBRICATING OIL and FUEL OIL!

DE LAVAL centrifugal equipment provides a time-proved method of keeping cutting oil, grinding coolant, washing oil, lubricating and other oils free from foreign substances. Thus, De Laval makes it possible by effectively removing metallic particles, dirt and water or sludge, to reap the many benefits that proper oil purification brings, over and above the obvious one of being able to use the oil again and again.

For example, the continuous removal of impurities from cutting oils through use of De Laval Oil Purifiers leads to improved quality of work, lengthens the life of the cutting tools, minimizes rejects and speeds up production.

There are a great many opportunities in most metal-working plants for De Laval machines to effect such economies. Some applications are shown in the panel at the left, but each plant will suggest its own possibilities for oil purification. And whatever the need, there is a De Laval machine of proper type and capacity to meet it.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

PURIFIERS AND CLARIFIERS FOR FACTORY OILS

The New
Hanna Air Cylinder
Catalog No. 234

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In this new Hanna catalog you can quickly find the model, size and other details of the air cylinders you need. It contains other very useful data you will want for reference. Specifications of operating valves are included in it also. Write for a copy today... at no obligation.

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Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

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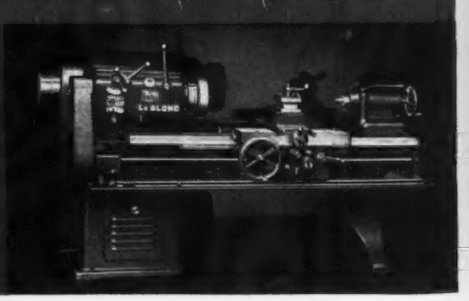
What's Industry's S
PHILADELPHIA ..OM

R. E. LEBLOND
President

'You're invited to listen in as LeBlond Agents over the Country phone in to Cincinnati. They're giving us the LeBlond story as it applies in their territories. Here are three LeBlond Men now . . .

"Everything from shoes to ships . . . that's the Philadelphia story. And that's what a lathe man has to produce here in the Philadelphia area. Our people know what's good in machine tools and, when they call for profit on quantity production, they get it. Our Rapid Production Lathes fill the bill when they need metal turned in a hurry to close limits. Here at THE U.S. AXLE COMPANY, INC., in Pottstown, ten LeBlond Rapid Production Lathes have upped production more than 50% and some manufacturing costs have been cut as much as 64% on a number of pieces."



FRANK MURPHY,
CALCO MACH. CO.,
PHILADELPHIA, PA.

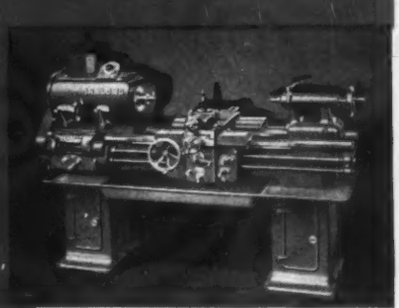
LeBlond 20" Rapid Production Lathe

All over industrial U.S.A., LeBlond lathes are pacing the drive to greater productivity with modern metal cutting and finishing performance. Look up the LeBlond Agent nearest you. He knows metal turning as few men know it and, since he handles the widest line of lathes ever offered by one manufacturer, he's pretty sure to have the answer to any lathe problem you have in mind.

's Story in

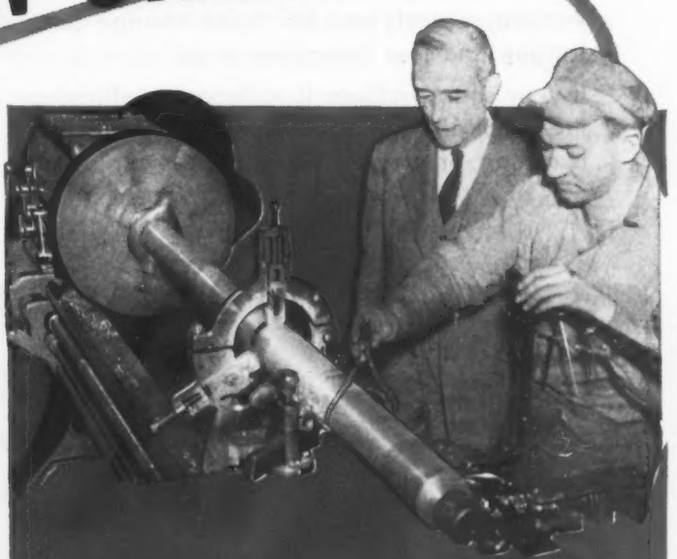
OMAHA . . . NEW ORLEANS . . .

"Omaha, gateway to the plains empire, is world-renowned for foods, feeds, medicine, and railroads. But we know our way around when it comes to farm and food machinery. The equipment we build is needed desperately now and Omaha producers have to get action. At the NEBRASKA SEED COMPANY, Ralston, Neb., I saw our Regal Lathes giving them that action. Doesn't cost much either. Farmers are going to get machinery and we'll get food. Omaha is on the job."

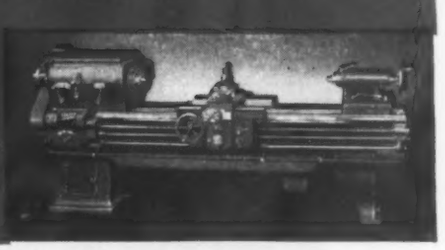


W. W. WARRINGTON,
T. S. McSHANE MACH. CO.,
OMAHA, NEBRASKA

LeBlond 17" Regal Lathe



"When you think of New Orleans, mightly pleasant things come to mind. Exotic foods, quaint architecture, the romance of the river . . . That's New Orleans and it makes living here very fine. But we have work to do, too, and we get it done efficiently and profitably. We've put LeBlond Lathes into enough plants to know that New Orleans likes them for the job they do. Here's a 21" Regal at PRAGER, INC., New Orleans. Prager makes a lot of gears and precision is their religion. That's why LeBlond gets the call.



EDWARD F. STAUSS,
STAUSS & HAAS, INC.,
NEW ORLEANS, LA.

LeBlond 21" Regal Lathe

The R. K. LE BLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

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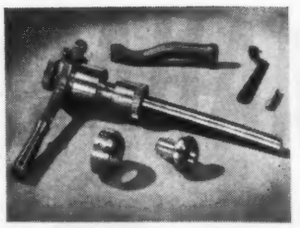
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

Increase Shop Capacity and Efficiency

Increase shop efficiency and you increase production capacity. Work moves smoothly, swiftly, surely, and in greater volume, through the efficient shop. Modern, efficient, precision machine tools are one of the first essentials for maximum efficiency.

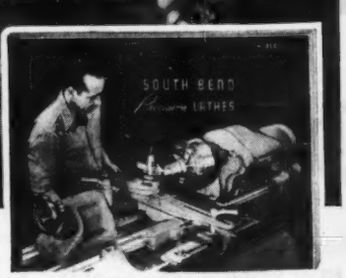
Famous for versatility, South Bend Precision Lathes bring peak efficiency to shops where frequent changes of set-up are called for and a variety of materials are used. And their modern design, with convenient controls and full quick change gear equipment, means less fatigue and less "machine scrap" due to such causes.

If your shop problem is to increase efficiency, it will pay to consider the installation of South Bend Precision Lathes when new equipment is added, or present equipment is replaced.



HANDLEVER COLLET ATTACHMENT
Permits releasing and feeding bar stock through the collet without stopping the lathe. Available with hardened ground steel collets, soft brass collets, or a combination of both. Write for Catalog No. 77 which shows all attachments.

Machining to split-thousandth accuracy is easy with a 16-inch South Bend Precision Toolroom Lathe.



Send For This Catalog
Write for your copy of Catalog 100-D which shows in color all styles and sizes of South Bend Toolroom, Turret, and Engine Lathes. Made with 9", 10", 13", 14½", and 16" swings. Accessories and attachments also shown.

SOUTH BEND LATHE WORKS
LATHE BUILDERS SINCE 1906
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HOW TO GET *Efficient* HYDRAULIC POWER FROM A 6-POUND SPUR GEAR PUMP

. . . even at 1000 psi

FOR APPLICATIONS LIKE THESE:

Materials handling equipment . . . farm machinery . . . machine tools . . . oil-well sampling . . . remote valve control . . . power transmission . . . and low-capacity, high-pressure circulating and delivery functions.

Pump shown approximately ⅔ size

SPECIFY McINTYRE SERIES 700 HIGH-PRESSURE POWER PUMPS

Delivering from .4 gpm at 200 rpm to 9.6 gpm at 1750 rpm against pressures up to 1000 psi, McIntyre Series 700 Precision Pumps offer you the benefits of a minimum tested volumetric efficiency of 90% and an average mechanical efficiency of 80% . . . ratings just recently made possible in pumps of this type.

McINTYRE PRECISION DOES IT

McIntyre mass-production machining methods are *capable of making surfaces flat to one light band and holding vital dimensions to toolroom tolerances of tenths and split tenths.* That's why the close fit of the aluminum body castings and nitrided nitralloy gears of these pumps keep slippage and wear at a minimum. And that's why more and more firms are specifying pumps and fluid motors carrying the red McIntyre Light-Band Trade-Mark.

WRITE FOR COMPLETE DATA

Whatever your possible use for McIntyre Series 700 High-Pressure Pumps—for hydraulic power, pressure lubrication, or low-capacity circulation or transfer applications—you'll want to study all the facts. Write for them today. The McIntyre Co., 200 Riverdale Avenue, Newton 58, Mass. . . . *also makers of precision spur gears to your specifications.*

THE McINTYRE CO.

PUMPS AND FLUID MOTORS

THE ULTIMATE IN PRECISION — *IDENTIFIED BY THE LIGHT BAND*

UNION SELF-CENTERING SCROLL CHUCK, QUALITY CONTROLLED FOR BETTER SERVICE . . .

The operation of our own foundry is only one of the controls which enables us to give you better chucks . . . when you want them. For instance . . . three types of metal are used in the major parts of the self-centering Geared Scroll Chuck shown above. The jaws are of a special analysis steel to withstand shock and wear. The pinions are made of chrome nickel steel, heat treated and ground. The scrolls are of special alloy steel forgings, heat treated for toughness. Our quality control insures the right steel for every part in this chuck and all others in the "broadest line of chucks in the world".

If you have a chucking problem, our complete engineering service or catalogs will help you. Why not write?

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UNION MANUFACTURING COMPANY

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73 PLANTS TELL YOU HOW THEY

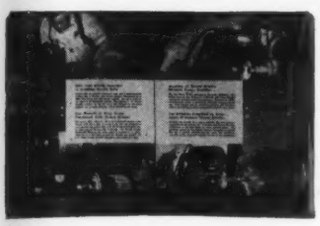
SOLVED GRINDING PROBLEMS!

PRODUCTION

How small shops expanded grinding facilities at low cost

How large plants reduced heavy investments.

TOOL ROOM



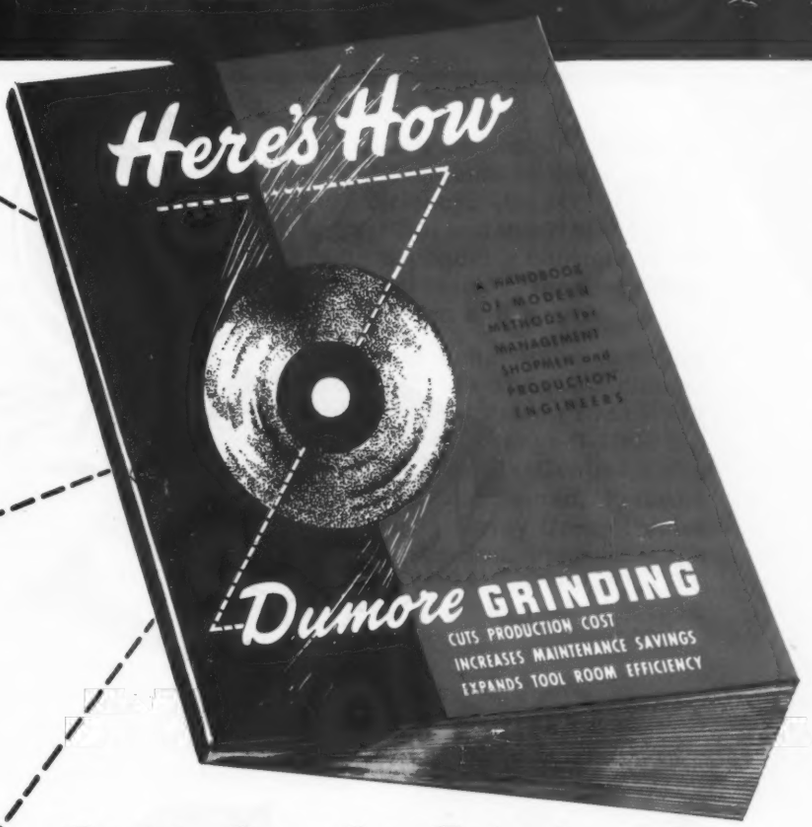
How a single grinder can be used on half a dozen tool room jobs.

How plants saved by doing their own grinding instead of sub-contracting.

MAINTENANCE

How plants cut maintenance costs by handling their own service work.

How a Dumore mounts on any standard machine tool to handle many jobs.

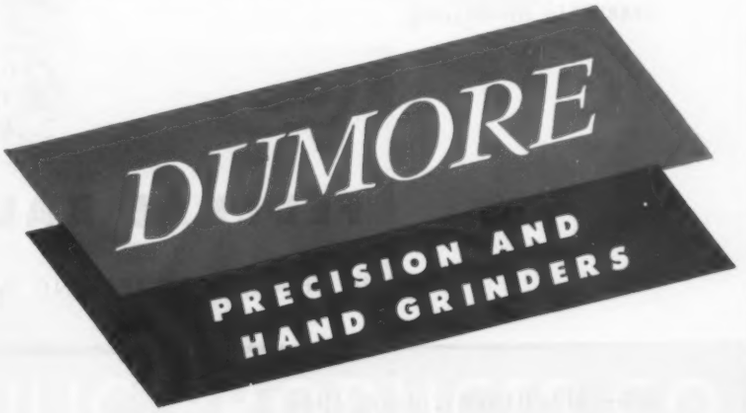

Here's How
A HANDBOOK OF MODERN METHODS for MANAGEMENT SHOPMEN and PRODUCTION ENGINEERS
Dumore GRINDING
CUTS PRODUCTION COST
INCREASES MAINTENANCE SAVINGS
EXPANDS TOOL ROOM EFFICIENCY

Send for Your Copy Today!

• "Here's How!", Dumore's new grinding handbook, takes you right into 73 different plants to disclose a wealth of facts on modern grinding methods. In seventy-five detailed case studies, drawn from wartime production experience, you'll learn how Dumore Precision Grinders have been used to cut costs . . . simplify operations . . . and increase efficiency. You'll discover ingenious solutions to difficult grinding problems, advanced, up-to-the-minute techniques that you can apply to the production line, the tool room and on maintenance. 198 step-by-step photo illustrations make every point clear. A complete cross-index makes data easy to find. For every management man, every shop man, every production engineer, Dumore's new "Here's How!" is "must" reading. Write for your copy today! The Dumore Company, Tool Division, Dept. TG28, Racine, Wisconsin.

Here's How!" Covers All These Subjects:

1. **INTRODUCTION.**
2. **LISTING** of 73 companies where studies were made.
3. **PRODUCTION** Grinding Applications, Pages 10-39.
4. **TOOLROOM** Grinding Applications, Pages 40-58.
5. **MAINTENANCE** Grinding Applications, Pages 59-65.
6. **DESCRIPTION** of the complete Dumore line of Precision and Hand Grinders, Pages 6 to 9 and 66-69.
7. **CROSS INDEX** by: Operations. Set-ups. Special Purpose Machines. Special Fixtures. Wet Grinding Operations. Materials. Indicating Devices. Protective Devices. Dressing Arrangements.



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The Quiet is in the Package, too!

Mount a Federal Bearing on a shaft...start the motor...then listen. The quiet you hear is a silent measure of Federal's over-all precision.

It means the ball track has been ground to a chatter-free finish and to just the right radius. The bore is cylindrical, not tapered or bell-mouthed; sides of the rings are parallel to each other and the ball track; the bearing is neither too tight nor too loose; and it has "purred" its way through Federal's rigid sound tests.

Rounding out this precision package are Federal-manufactured balls, uniformly spherical within .000025" and not varying in diameter more than .00005" in any bearing.

Before any Federal Ball Bearing starts on its way to industry's assembly lines it has gone the route of over 100 individual production, inspection and cleaning operations ...with *every fourth operator an inspector.*

It all adds up to quiet running and smooth, friction-less operation wherever moving parts turn on Federal Bearings.

That's why, *wherever tolerances are tight,* specify Federal Ball Bearings...in any range or size--

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, NEW YORK

Makers of Fine Ball Bearings

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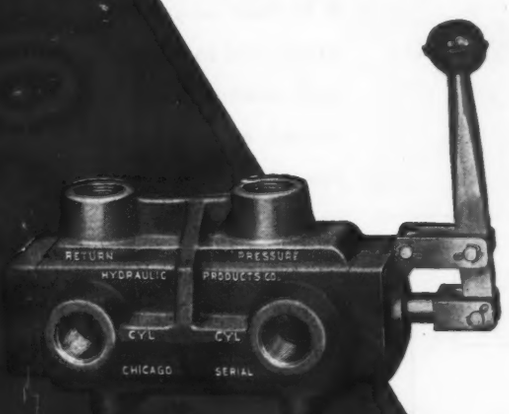
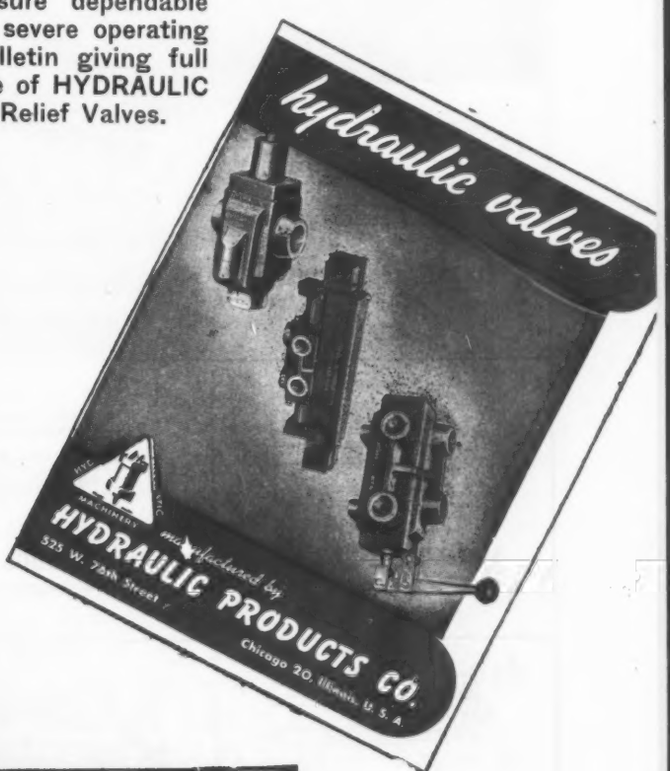
ONE OF AMERICA'S LEADING BALL BEARING MANUFACTURERS

Choose "HYDRAULIC" for Dependable Control of Efficient Hydraulic Power

Hydraulic power, applied to feeds and speeds in machine tools, as well as to the actuation of all types of movements in other equipment, has proved its dependability and efficiency. Use HYDRAULIC PRODUCTS Cylinders to provide the power . . . and use HYDRAULIC PRODUCTS Control and Relief Valves for dependable control . . . for making infinite changes in rates of speed and feed . . . for controlling rate and direction of movements throughout an entire cycle.

Every HYDRAULIC PRODUCTS Control and Relief Valve is tested for 3600 operations at 125% of normal operating conditions. Illustrated at left (reading downward): (1) Relief Valve (Type R75) for regulating and limiting fluid pressure. Pressure range 0-1000 lb., pipe sizes ½" to 1¼". (2) Hand-operated 4-way Control Valve (Type HCC75); used where remote control is not desired. Pressure range 0-1000 lb., pipe sizes ½" to 1¼". (3) 4-way Control Valve (Type U100) solenoid-operated. Pushbutton control. Pressure range 0-1000 lb., pipe sizes ½" to 1¼". All HYDRAULIC PRODUCTS Valves have full port openings and free flow internal passages. Careful design, best raw materials and careful workmanship assure dependable performance under most severe operating conditions. Send for bulletin giving full data on the complete line of HYDRAULIC PRODUCTS Control and Relief Valves.





THE COMPLETE "HYDRAULIC" LINE includes a Hydraulic Pumping Unit, a Hydraulic Furnace Pusher Unit, a full line of Hydraulic Cylinders with various mountings for different types of application, and a wide range of Hydraulic Control and Relief Valves.

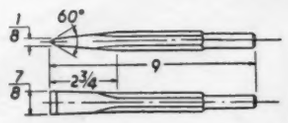
HYDRAULIC PNEUMATIC
TRADE MARK
MACHINERY

HYDRAULIC PRODUCTS CO.

525 W. 76TH ST. CHICAGO 20, ILL. U.S.A.

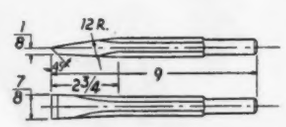
47 SIZES AND STYLES OF CLECO CHIPPERS

No. 3 WA Chipper with ratchet lock handle.

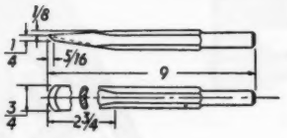


FLAT OR COLD CHISEL
Additional Lengths 12, 18, 24

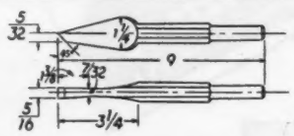
JUST A *FEW* OF THE MANY HELPFUL CHISEL DRAWINGS IN BULLETIN 75B



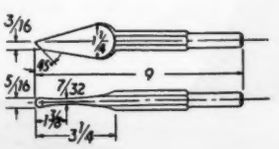
SIDE CUTTING CHISEL
Additional Lengths 12, 18, 24



GOUGE
Additional Lengths 12, 18, 24



CAPE CHISEL
Additional Lengths 12, 18, 24



ROUND NOSE CHISEL
Additional Lengths 12, 18, 24

Send for Bulletin 75B, FULLY DESCRIBING THE MANY TYPES OF CLECO CHIPPERS

● In this large, varied line you will find the *exact* tool for *every* chipping, calking, beading, and scaling requirement. Either the open or closed style of handle may be had, and, for the open type, you have a choice of either a bolt or a ratchet locking device. There is also a choice of two valve mechanisms, both efficient and practically breakage-proof.

Cleco Chippers use a throttle valve that graduates the air supply, thus giving a smooth start to the piston, minimizing recoil and making the hammer easy to hold and control on the work. Furthermore, Cleco Chippers "stand the gaff" because they are extra-tough. Plungers and chisel bushings are made of hardened and tempered tool steel, ground to close limits. The cylinders are made of selected alloy steels, carefully heat treated to insure super strength.

THE CLEVELAND PNEUMATIC TOOL COMPANY
3781 EAST 77TH STREET — CLEVELAND 5, OHIO
BRANCH OFFICES IN ALL PRINCIPAL CITIES

LONGER GAGE LIFE...

12½ TO 1

5-PLUS FEATURES

1. Greater accuracy and stability
2. Longer wear life
3. Less weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

WOODWORTH THREAD RING GAGE PROVES AMAZING SUPERIORITY OVER ORDINARY GAGES

Records for durability . . . for accuracy . . . for economy! They're being established regularly with the new Woodworth Adjustable Thread Ring Gage.

AUTHENTIC SHOP ACCOUNTS TELL OF MAINTAINING ACCURATE INSPECTION AS MUCH AS TWELVE AND ONE-HALF TIMES LONGER THAN ANY OTHER RING GAGE — AND ALL THIS ON EXTRA-TOUGH JOBS. CHECK THIS RECORD AGAINST YOUR EXPERIENCE . . . CONSIDER WHAT IT CAN MEAN IN CUTTING GAGE COSTS!

Then wire or write for our folder No. 46R.

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINE PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS

YOU'LL APPRECIATE THIS KIND OF "PRICE CONTROL"

The soundest cost (and price) control in the world is free and fair competition based on production with the most modern tools—most efficiently applied.

The specialty of Sommer and Adams for more than a quarter of a century has been the designing and building of special purpose machinery—mostly aimed at doing something no other machine will do, all aimed at cutting time and cost in production. S and A creations range all the way from two-story, fully automatic multi-operation machines to small items like the Cleveland Vertical Milling Machine, at left.

This is a small, rigid, high-speed unit embodying all of the features essential to modern milling practices. Popular demand has converted it from a special machine to a standard item which thousands of tool and die makers, and production plants find a practical necessity.

Ten chances to one there's a spot for one of these productive machine tools in your shop.

It is probable, too, that S and A have the answer, in their years of special design experience, to some particular production problems hampering *your* cost control.

Let us send an S and A engineer to discuss it with you.

THE SOMMER & ADAMS COMPANY

18515 EUCLID AVENUE, CLEVELAND 12, OHIO

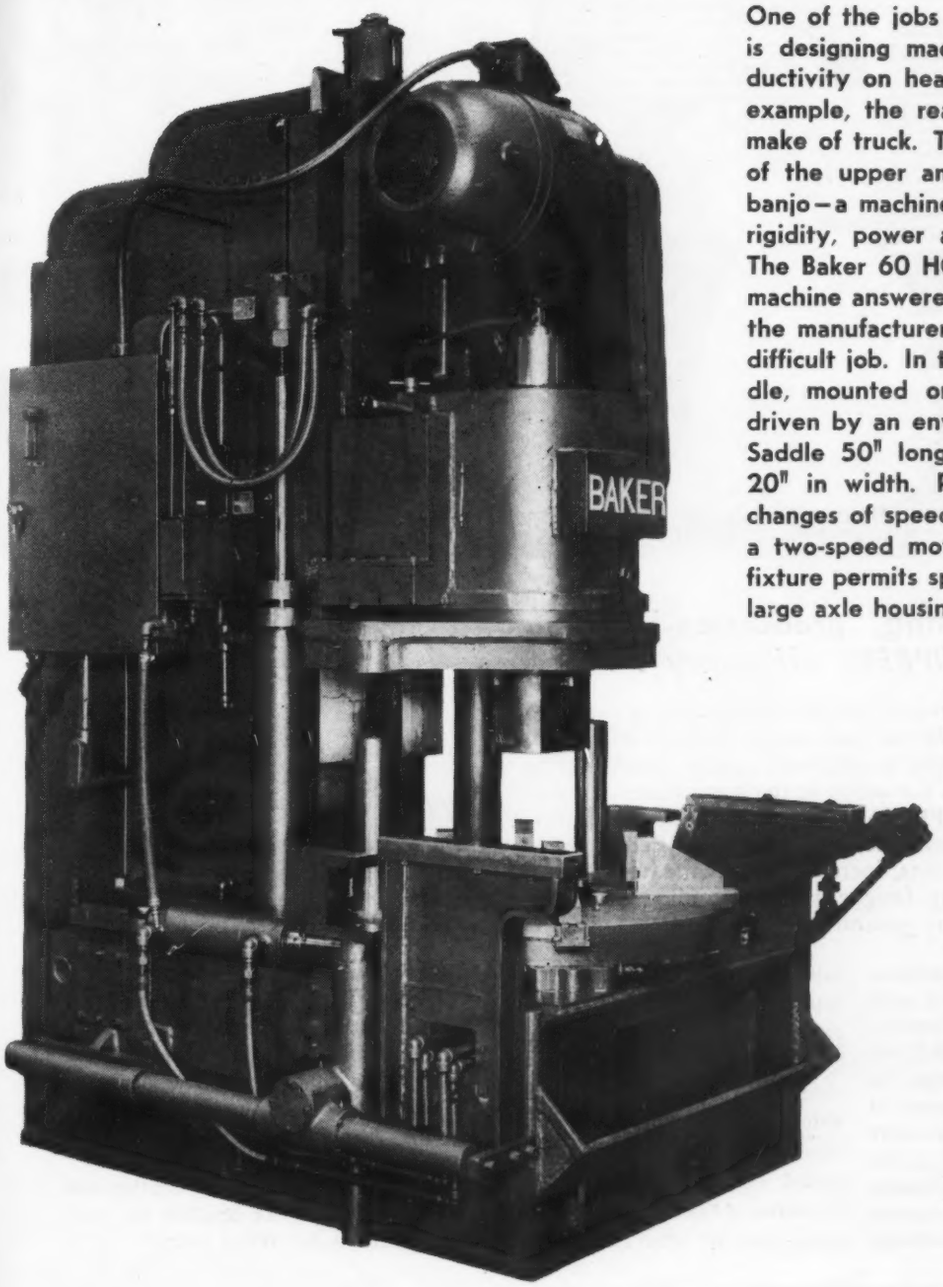
Custom-Built EQUIPMENT FOR MANY PURPOSES

SUBSIDIARY OF THE FEDERAL MACHINE AND WELDER COMPANY

AUTOMOTIVE PLANT REPORTS

Increased Productivity

BORING REAR AXLE HOUSINGS ON THE NEW BAKER 60 HO-4 EXTRA HEAVY DUTY MACHINE



One of the jobs which Baker Brothers do best is designing machines to give increased productivity on heavy duty operations. Take, for example, the rear axle housing for a popular make of truck. The job called for rough boring of the upper and lower bores in the center banjo—a machine was needed which combined rigidity, power and high productive capacity. The Baker 60 HO-4 vertical boring and facing machine answered these demands, and enabled the manufacturer to get increased output on a difficult job. In this machine the oversize spindle, mounted on preloaded ball bearings, is driven by an enveloping worm and worm gear. Saddle 50" long is mounted on ground ways 20" in width. Pick-off gears give two quick changes of speed, or four spindle speeds with a two-speed motor. A special quick-operating fixture permits speedy, accurate locating of the large axle housings being bored.

For extra heavy drilling, large diameter boring or sweep facing, get our recommendations for tooling up the 60 HO-4 for increased productivity.

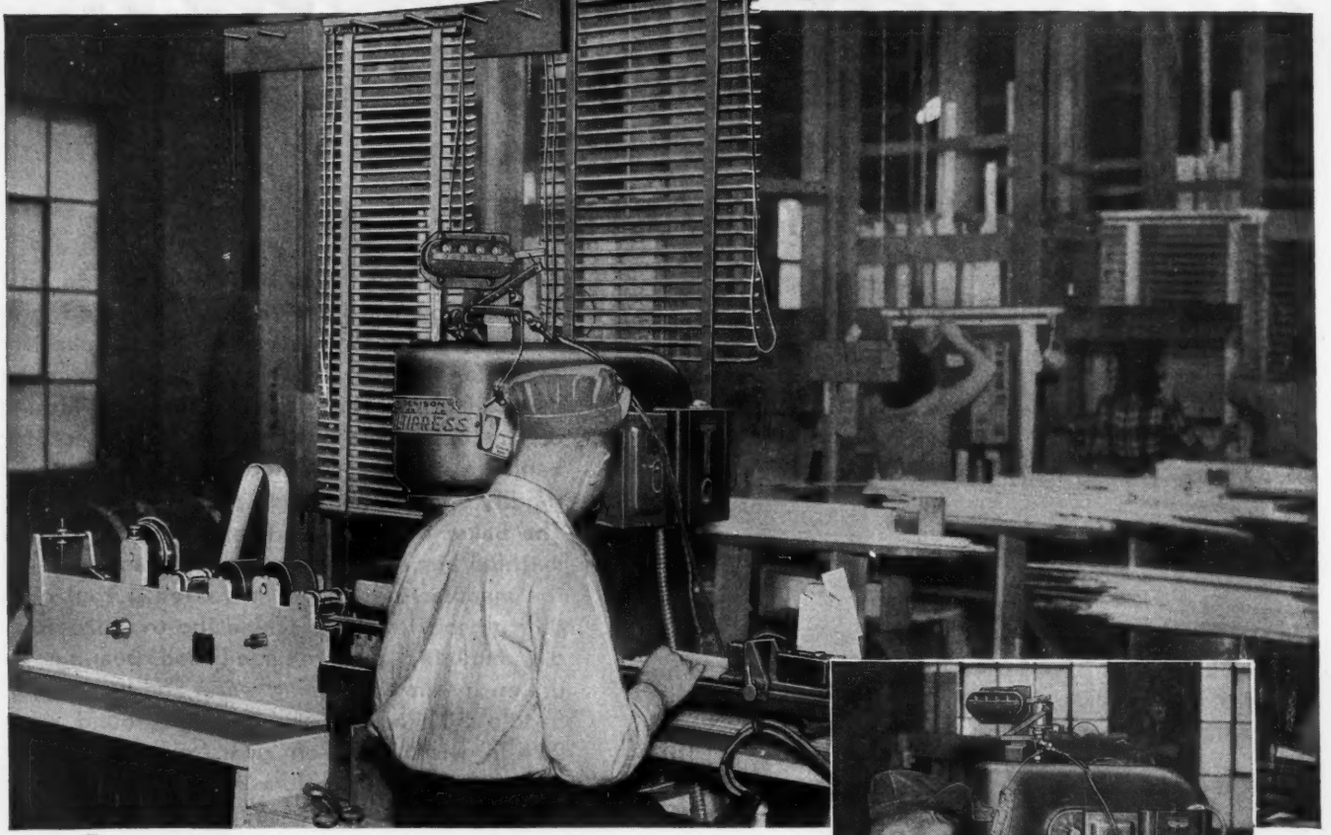
•

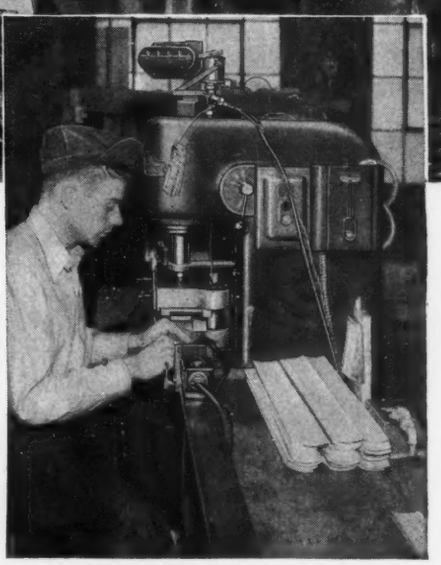
Baker machines are designed, not to eliminate the human element, but rather to relieve the operator of as much physical effort as possible, so that he can do a faster, more efficient job with greater ease and less fatigue.

SINGLE AND MULTIPLE SPINDLE MACHINES FOR DRILLING, BORING, FACING, TAPPING

BAKER BROS., INC. TOLEDO 10, OHIO

Knocking the slats out of strip metal with MULTIPRESS





Another cost-cutting, production-boosting example of *MULTIPRESS* efficiency . . .

With a quick, automatic pressure stroke that's carefully preset to get best results *with minimum tool wear,* MULTIPRESS cuts venetian-blind slats to proper length with neatly rounded ends — and punches out eyelets for cords at the same time. It's just *one* of the tasks MULTIPRESS is doing for Yardley Industries, Columbus, Ohio — one of *hundreds* of different ways MULTIPRESS is cutting costs, increasing output, saving space, improving quality, reducing fatigue, slashing tooling costs and solving problems for industry generally!

Built in 4, 6, and 8-ton capacities, and featuring a wide choice of models with either manual or automatic-cycling controls, MULTIPRESS can provide any type of ram action required. In addition, a wide range of accessories and toolings, specially designed for the MULTIPRESS, extend its efficiency to an amazing variety of operations. Accessories include side shelves, extension tables, bolster plates, and cabinet-type benches. Tooling fixtures cover straightening, indexing, pelleting, and similar needs. And the remarkable new Vibratory Ram Action provides from 1 to 25 short, uniform, closely regulative strokes per ram cycle!

Features of the basic 4-ton unit give some idea of what MULTIPRESS offers. Its ram stroke is adjustable from 1/16-inch to six inches . . . downward pressures range from 300 pounds to 8000 pounds at 200 ipm . . . upward pressures range up to 5000 pounds . . . the unit measures only 16 x 26 x 34 inches, and weighs only 725 pounds!

Let us send you information on MULTIPRESS as applied to your specific needs. Write today!

The DENISON Engineering Co. — DENISON EQUIPMENT in APPLIED HydrOILics — 1152 Dublin Rd., Columbus 16, O.

a MACHINIST is only as good as his TOOLS

In tool-room, shop or on the production line, output per worker depends largely upon the tools at hand. That's why keen management depends on Williams for Tool Holders, Lathe Dogs, "C" and Strap Clamps . . . those "personal" tools that are the everyday teammates of highly-paid mechanics.

Williams Machinists' Tools are all drop-forged and produced with exacting skill to high standards of design and workmanship. Write for a copy of Booklet describing these fully guaranteed tools today. Williams Machinists' Tools are sold by leading Industrial Distributors everywhere.

J. H. WILLIAMS & CO., **BUFFALO 7, NEW YORK**

SERVICE ALL THE WAY

OTIS MAINTENANCE FOR OTIS ELEVATORS

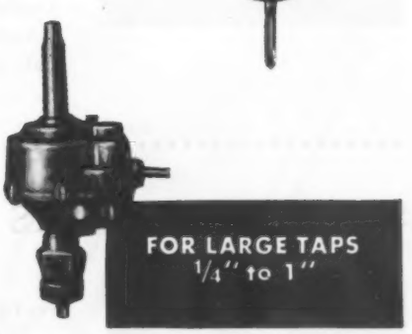
• Otis Maintenance extends all of the facilities and ability of the manufacturer directly to the buildings of Otis elevator owners.

To bring this service to your door, Maintenance operations are conducted by 245 local Otis offices, each adapted to the area it serves. These branch offices in turn have the benefit of progressive improvements in service developed by the facilities that produced more than half of the world's elevator equipment. Thus Otis Maintenance goes all the way to meet the convenience of the Otis elevator owner.

Few things you buy can so exactly fit your needs.

Maintenance by Otis, for Otis elevators, is available at a flat monthly rate through your local Otis Elevator Company office.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES



YES SIR, put one of these Ettco-Emrick Tapping Attachments on the spindle of your drill press and you've got a combination that's tops for fast, accurate tapping — with maximum protection against tap breakage and work spoilage. With an Ettco-Emrick Tapping Attachment you can get all the extra tapping capacity you need at minimum tool cost.

For full details

WRITE FOR BULLETIN NO. 2

ETTCO TOOL CO.

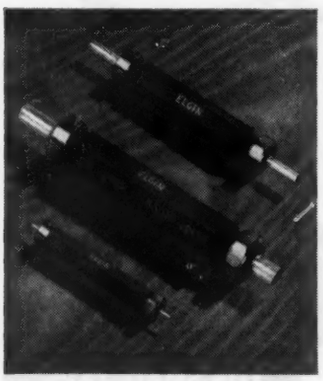
592 Johnson Avenue, Brooklyn 6, N. Y.

Detroit 1 • Chicago 6

Over 25 years specialization in solving industry's drilling and tapping problems

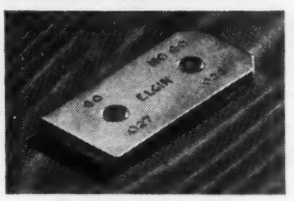
5 WAYS in which the amazing wear resistance of ELGIN Sapphire serves industry...

1. PLUG GAGES



Outwearing steel more than 7000 to 1! This means *savings* in replacement costs, worn gage rejects, gage checking time plus improved and increased production. Single and double end styles. Sizes from .040 to .400. Tolerances down to .00002. No "wear allowance" necessary—order right to size.

2. RING GAGES



Made of same hard, non-wearing Sapphire as Elgin Plug Gages. One manufacturer got 1,100,000 gagings as compared with 150 from steel. Sizes as small as .004. Tolerances down to .00004. Available in single ring and twin ring styles.

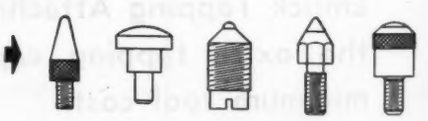
3. SAPPHIRE TIPT MICROMETERS

A superbly engineered lightweight micrometer with tough Elgin Sapphire mounted on the anvil and spindle. Original one still in use after more than 2,000,000 gagings. A micrometer to give readings you can be sure of. Guaranteed to .0001 accuracy. Available in one, two and three-inch sizes for immediate delivery.

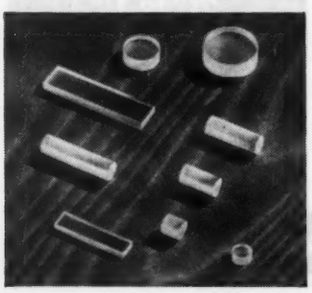
4. DIAL INDICATOR CONTACT POINTS

Another proved application of Elgin Sapphire. Better work at a savings because these points cannot scratch or mar surfaces. Dimensionally stable. Unaffected by acids. Non-porous. Monocrystalline. Standard 4-48 thread or to your specifications.

Examples of various contact points we have made.



5. STANDARD SHAPES



Rectangles, cylinders, round flats. You can easily affix these pieces to the wear surfaces on machines, tool rests, gages, etc. Stock items ready for immediate shipment.

SPECIFY ELGIN SAPPHIRE FOR DIMENSIONAL FIDELITY IN GAGING OPERATIONS

SAPPHIRE PRODUCTS DIVISION
ELGIN NATIONAL WATCH COMPANY, AURORA, ILLINOIS
Representatives in cities from coast to coast

INSIST ON haskins DURABILITY

In the flexible shaft line durability counts—and Haskins Flexible Shaft Machines *are* durable.

These portable tools will stand continuous hour after hour use—three shifts a day—seven days a week. They'll turn out more work—better work—faster and easier, with longer trouble-free operation. For grinding, sanding, rotary filing, wire brushing, buffing or polishing—use Haskins machines—use them hard. They won't let you down! Send for details.

HS-7
1 H.P. Multi-speed countershaft unit. 975 to 3100 RPM. Three wheel heavy duty truck. 360° motor swivel.

R. G. HASKINS COMPANY
617 S. CALIFORNIA AVE • CHICAGO 12, ILLINOIS

HASKINS

haskins
FLEXIBLE SHAFT EQUIPMENT

Use HIM...and the

picture is complete

Key figure in modern efficient buying, your local CARBORUNDUM distributor offers prompt intelligent service for your abrasive requirements. No one is in better position to give you what you want, how you want it, and when you want it. From large and varied assortments of standard types, sizes and shapes, your order for wheels, coated abrasives, and sticks by CARBORUNDUM receives immediate attention.

Prompt delivery is assured. Delays are eliminated. There is no need, on your part, to carry extra large inventories.

Whether it's a standard order, a request for product information, a question of availability and delivery, or even advice on an engineering problem, you will find your CARBORUNDUM distributor ready and able to serve. In his daily contacts, he is called in on many abrasive applications involving a variety of problems. Often he is able to offer a new solution. And when the situation is unusual, he can always call in a CARBORUNDUM abrasive engineer for practical assistance.

In the handling of abrasive products by CARBORUNDUM, your industrial supply distributor is backed by outstanding product reputation. These abrasives often help to do a better job, faster and cheaper.

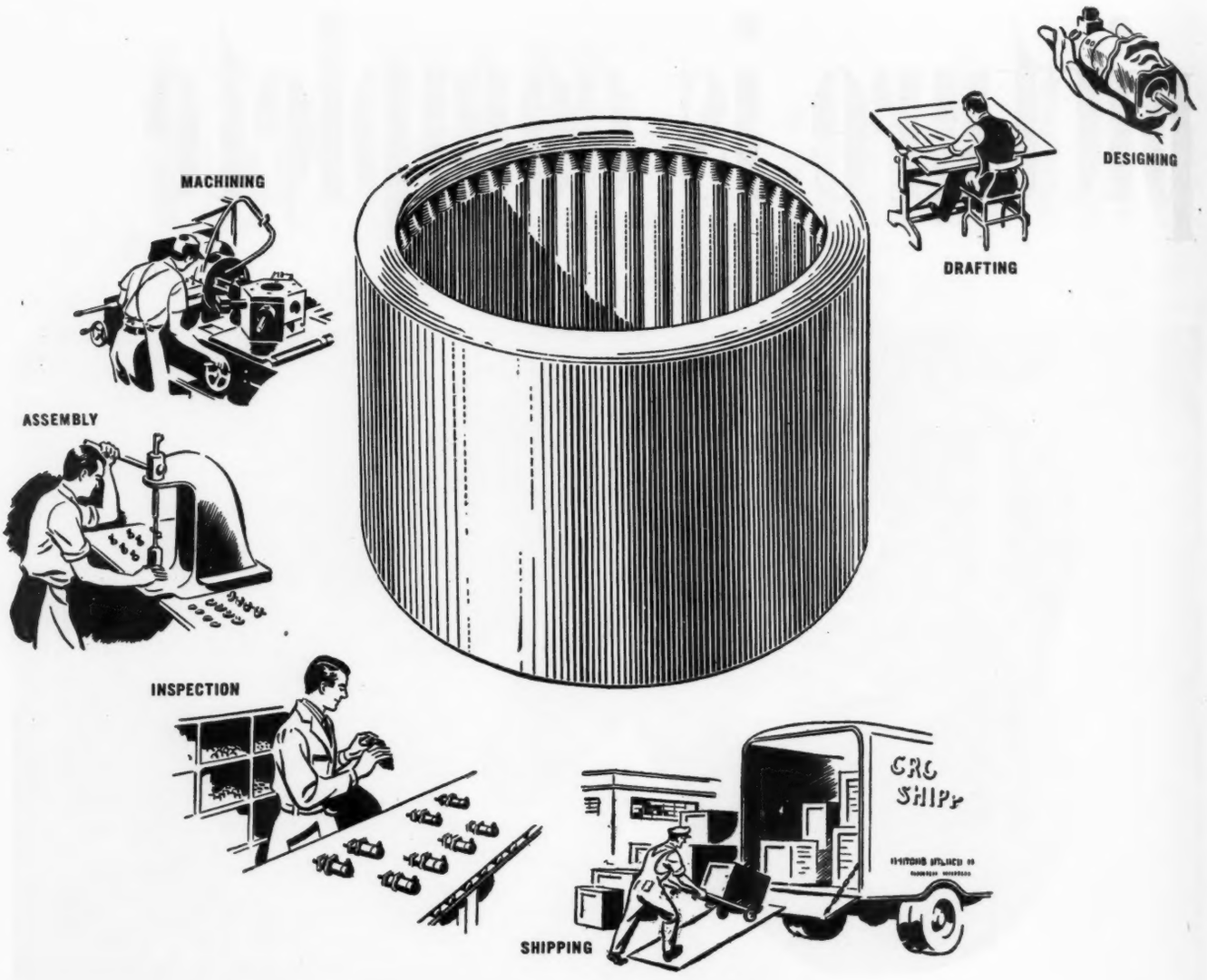
Remember, for standard applications, your CARBORUNDUM distributor can give you the right abrasive product for the job—*plus* unexcelled sales service. The next time a CARBORUNDUM distributor's representative calls, give him the opportunity to explain more fully the benefits you obtain from dealing with this ideal source of supply for abrasives. The Carborundum Company, Niagara Falls, New York.

A good rule for good distributor service... **CALL IN** *your*

CARBORUNDUM DISTRIBUTOR

TRADE MARK

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company



Here's Anti-Friction Performance for Assembly Lines, too...

One thing about using Torrington Needle Bearings that the plant men appreciate is the way they can help to speed up the efficiency of assembly lines.

It's not only that their *unit construction* simplifies handling and speeds installation. The advantages start right back in the design stage where their small size and light weight help to solve many related design problems.

Then getting ready for production is easier, too. No elaborate tooling-up is necessary—a plain bore, machined to proper dimensions, provides the bearing housing.

Installation is a simple press fit...a single arbor press operation sets the bearing in position. No spacers or retainers are required to hold Needle Bearings in place.

And because of the efficient lubrication of this modern anti-friction unit, special or complicated systems for lubrication are never required. Even oil seals are unnecessary in many applications.

So, when you adopt the use of Needle Bearings, you can count on increased efficiency of your own production lines. And that's something we're all looking for these days.

Our engineering department will gladly assist you in securing full benefits from the use of Needle Bearings.

●

THE TORRINGTON COMPANY

TORRINGTON, CONN. SOUTH BEND 21, IND

Offices in All Principal Cities

TORRINGTON NEEDLE BEARINGS

a PERFECT rivet every time . . .

Hannifin "Hy-Power" hydraulic riveters are providing fast, high quality riveting performance on a great variety of work. The "Subway" grating being assembled here is a typical example of high production due to the fast, easy handling of "Hy-Power" equipment. Tight, uniform rivet application is a characteristic of the "Hy-Power" hydraulic squeeze action which not only forms a perfect head, but spreads the rivet body to fill the hole better and tighter than is done by hammer riveting.

Hannifin "Hy-Power" equipment provides fast production and the uniform quality of work so necessary for today's needs of economical manufacture. "Hy-Power" equipment is also adapted to press-fit assembly, punching, and multiple punching and riveting operations. Write for bulletin with complete data.

Hannifin Manufacturing Company, 621-631 S. Kolmar Avenue, Chicago 24, Illinois.

HANNIFIN · CHICAGO · USA

"hy-power"

RIVETERS · PUNCHES · PRESSES

Thor
AUTOMAGIC
GLADIRON

WITH
MADISON-KIPP
ALUMINUM
DIE CASTING
E-X-T-E-N-S-I-O-N
B-O-A-R-D-S

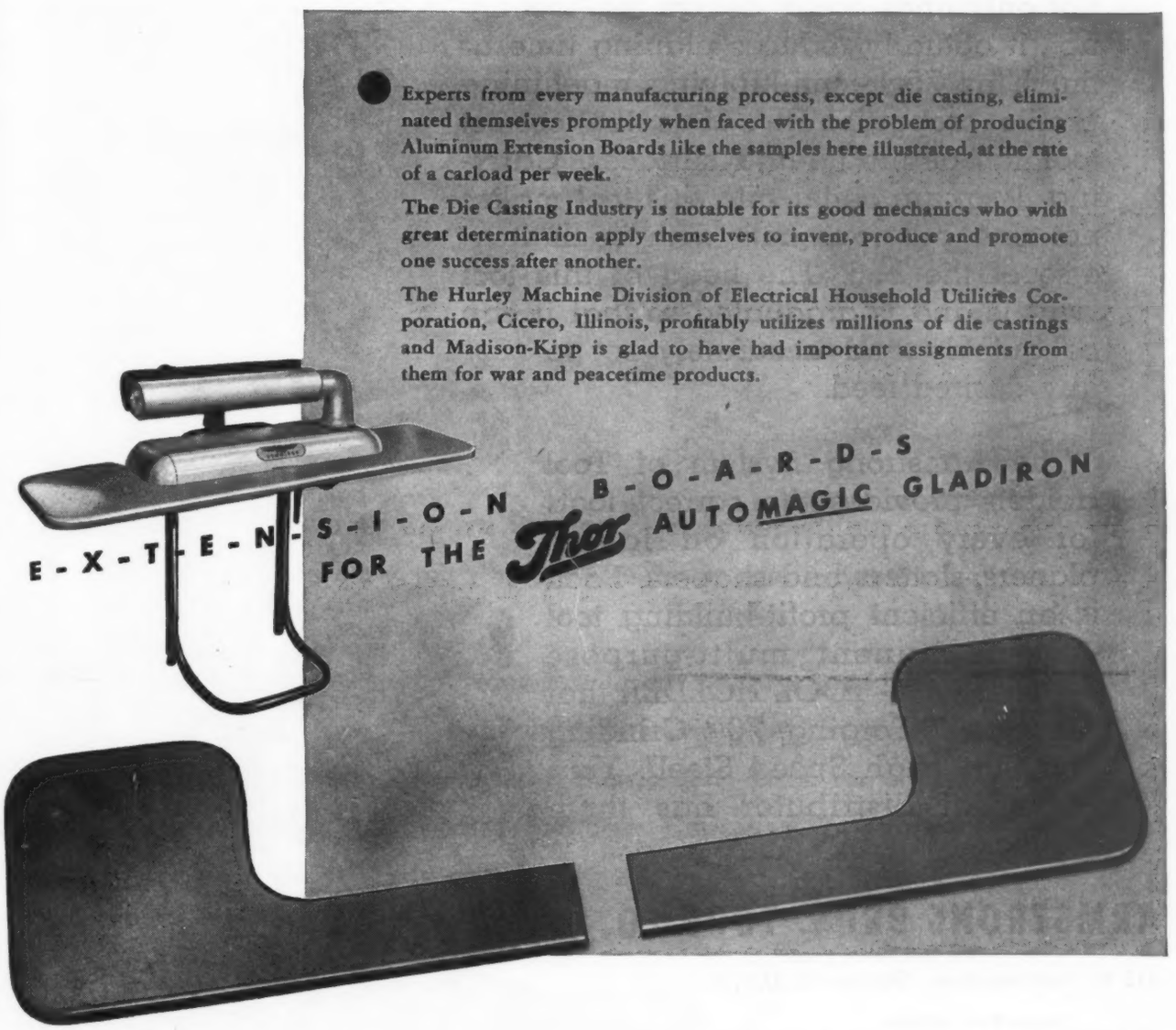
THE MANUFACTURER
SAYS ABOUT THIS PRODUCT

"If your husband did the ironing just once . . . he'd sign up for a Gladiron, tomorrow."

MADISON-KIPP
Experts **IN ALUMINUM DIE CASTING**

MADISON-KIPP ALUMINUM DIE CASTING

by the Hi-High pressure process —light, strong, attractive, durable


Experts from every manufacturing process, except die casting, eliminated themselves promptly when faced with the problem of producing Aluminum Extension Boards like the samples here illustrated, at the rate of a carload per week.
The Die Casting Industry is notable for its good mechanics who with great determination apply themselves to invent, produce and promote one success after another.
The Hurley Machine Division of Electrical Household Utilities Corporation, Cicero, Illinois, profitably utilizes millions of die castings and Madison-Kipp is glad to have had important assignments from them for war and peacetime products.
E-X-T-E-N-S-I-O-N B-O-A-R-D-S
FOR THE Thor AUTOMAGIC GLADIRON

MADISON-KIPP CORPORATION

203 WAUBESA STREET • MADISON 4, WIS., U.S.A.

Skilled in die casting mechanics, experienced in lubrication engineering, originators of really high speed air tools.

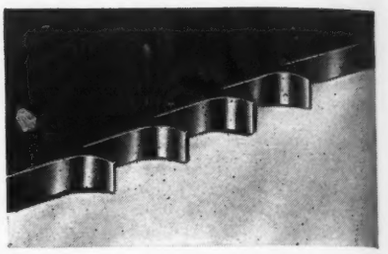
ANCIENTS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium — sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England—sole agents for England, most European countries, India, Australia, and New Zealand.

ARMSTRONG

SYSTEM OF TOOL HOLDERS

Doubles (even triples) Planer Production



As each chip is comparatively light, a planer will, with this tool, carry with ease a feed and depth of cut much greater than is possible when using an ordinary tool, and there is much less tendency to "break out" at the end of cut.

The ARMSTRONG Gang Planer Tool not only ends costly delays for "tooling-up", it actually reduces planing time as much as 75% — multiplying machining profits proportionally. It is the correct tool for planing large surfaces. Carrying 4 square cutter bits, this tool makes not one but four cuts with each traverse of the bed. The head of this tool swivels and is graduated so that it can be quickly and accurately set to any desired feed.

The Armstrong System of Tool Holders provides the correct tools for every operation on lathes, planers, slotters and shapers. Each is an efficient profit-building tool — a permanent multi-purpose ARMSTRONG TOOL HOLDER that "Saves: All Forging, 70% Grinding and 90% High Speed Steel". Your industrial distributor has them in stock.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

313 N. Francisco Ave., Chicago 12, U. S. A.

Eastern Whse. and Sales:
199 LAFAYETTE ST., NEW YORK 12, N. Y.
Pacific Coast Whse. and Sales Office:
1275 MISSION ST., SAN FRANCISCO 3, CALIF.

Bunting Bronze Bars and Standard Bearings are procurable from distributors' stocks in many hundred cities.

The name Bunting long has been synonymous with finest quality. The availability is immediate—from your nearest Bunting Authorized Distributor. Write for Catalog. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in principal cities.

Bunting

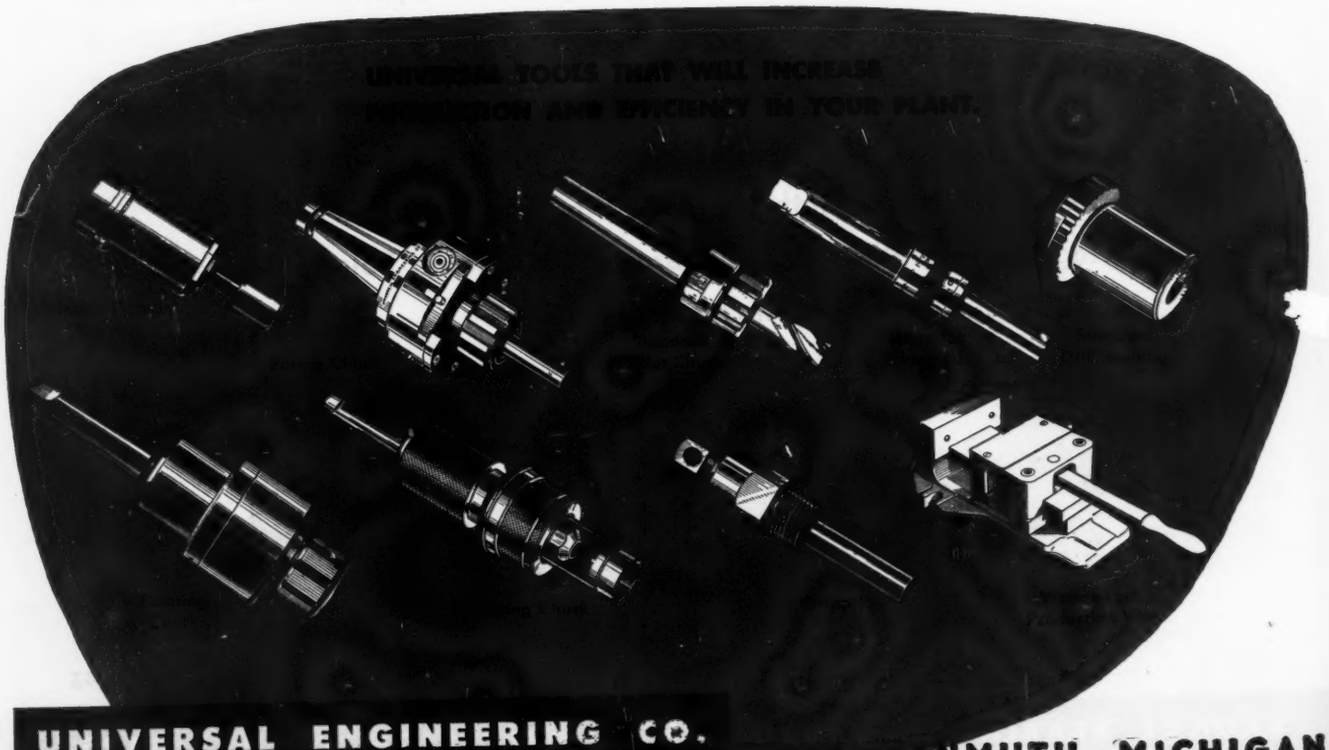
43

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

SPEED PRODUCTION

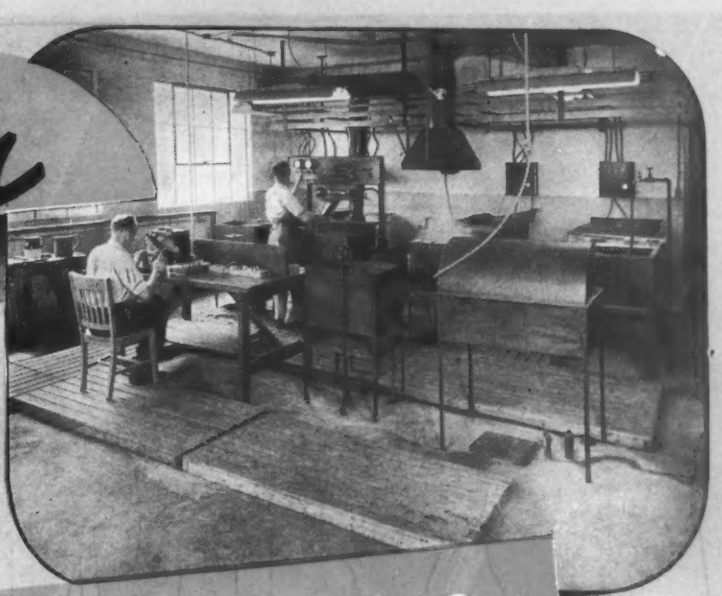
ELIMINATE FAULTY SCREW MACHINE CENTERING AND DRILLING WITH UNIVERSAL ADJUSTABLE COLLET CHUCKS

No more drilling bell-mouthed holes or reaming with a taper on screw machine work! The Universal Adjustable Collet Chuck for screw machine use provides quick correction of angular misalignment in any direction. Cross key center driver is keyed at right angles to shank and to nose piece. A line scribed across segments of 3-piece driver makes alignment quick and easy and shows instantly the approximate amount that chuck is off center. Flats can be indicated to determine the exact amount of offset. Two clamping screws lock tool firmly in position after it is entered in correctly located hole. If your production set-up demands centering and drilling operations in exact line with screw machine index, it will pay you to standardize with Universal Adjustable Collet Chucks. Write today for complete information.



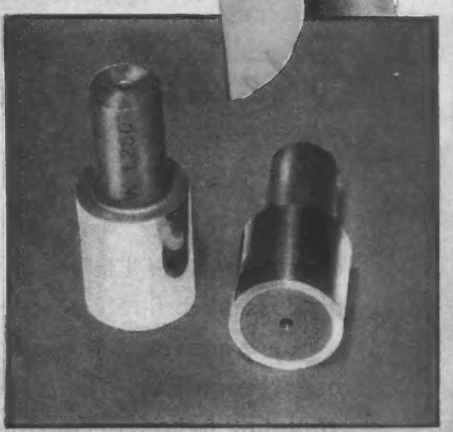
UNIVERSAL ENGINEERING CO. FRANKENMUTH, MICHIGAN

Van Keuren



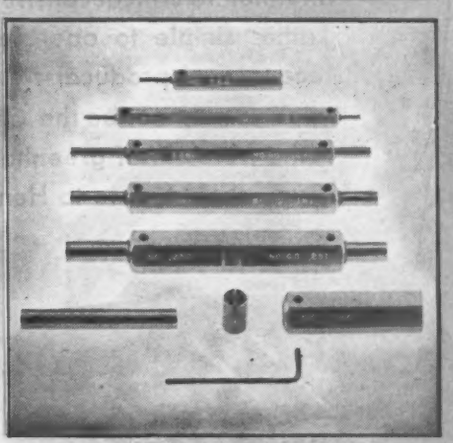
PRECISION CHROMIUM PLATING

applied to Plug Gages



THE Van Keuren Co. has developed a new method of precision chromium plating of wire type and taper insert plug gages. In this modern plant we have combined the best available plating practice with the ability to make precision measurements. We are able to deposit a chromium wear surface accurate to a few millionths of an inch. Gages are finished to the low wear limit and then are plated to the high wear limit. The result is a thin, closely adhering wear surface which will not crack or peel and which is available at a very moderate cost.

Instead of paying 50 to 75% additional for chromium-plated gages, they are now available for only 25% additional and they wear 3 to 5 times as long as steel gages. The many repeat orders which we are getting from large users indicate that this new method is resulting in more prompt deliveries, greater wear [illegible]er gage cost, and satisfied customers. For your next gaging job, specify Van Keuren chrome-plated gages.

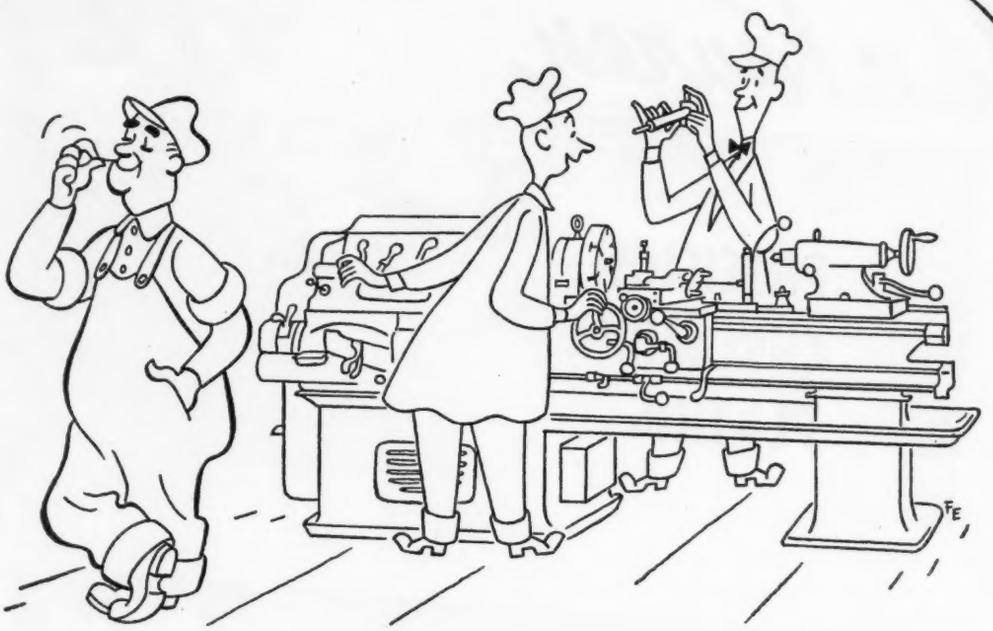


Handbook and Catalog No. 33

THE Van Keuren CO., 178 WALTHAM STREET, WATERTOWN, MASS.

27th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires.



The story of the Bull with the Greenhorns

Once upon a time greenhorns got in the Old Bull's hair, but those trying times can be banished forever. Ask any Old Timer who has Hendey Precision Tool Room Lathes in his department. He'll tell you it's a pleasure to run them—they're easy to operate—they produce such fine work—they're ideal for training greenhorns.

There are sound reasons for this—reasons for which Hendey engineers and designers are responsible. Their forward thinking and functional designing—their particular attention to critical construction features combine to make Hendey Precision Tool Room Lathes simple to operate, absolutely chatter-free, exceptionally accurate, fast and economical producers.

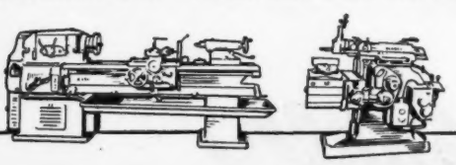
You may not be the Old Bull in your shop, but if you are interested in speeding the training of greenhorns, plus improving tool room work and reducing costs, you should write to Hendey today.

The Hendey Machine Company

Hendey

Main Office and Plant—Torrington, Connecticut

Branch Offices—New York, Chicago, Boston, Detroit, and Rochester
Representatives in—Phila., Cleveland, Los Angeles, Pittsburgh, San Francisco



TOOL ROOM LATHES
12"-14"-16"-18"-20"-24"

SHAPERS
12"-16"-20"

High speed steel cutter combining boring, counterboring, chamfering, and facing operations.
Tungsten carbide tipped tool facing, boring, cutting radii, and chamfering 23 and 45° angles.
Inserted blade cutter for counterboring, boring, and cutting radii in aluminum cylinder head.

Cutting Tool Engineering

To do production work on metal parts *economically* these multi-operation tools are an unequalled help. By combining several operations they are *faster*, by insuring perfect concentricity between diameters they hold consistently to close tolerances.

Designed with either inserted blades or flutes independent of each other and carefully proportioned, the length of each cutting edge is easily maintained.

GAIRING'S *Cutting Tool Engineering* developed the tools of which examples are shown here. If you too can use our services get acquainted. Write for our condensed catalog or our comprehensive catalog which gives complete descriptions of all our products.

THE GAIRING TOOL COMPANY, Detroit 32, Michigan

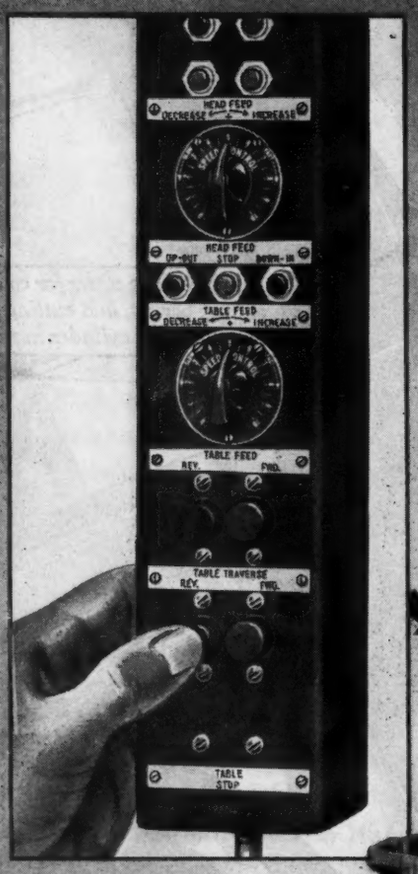
GAIRING TOOLS

MANUFACTURERS OF STANDARD AND OF SPECIAL PRODUCTION CUTTING TOOLS

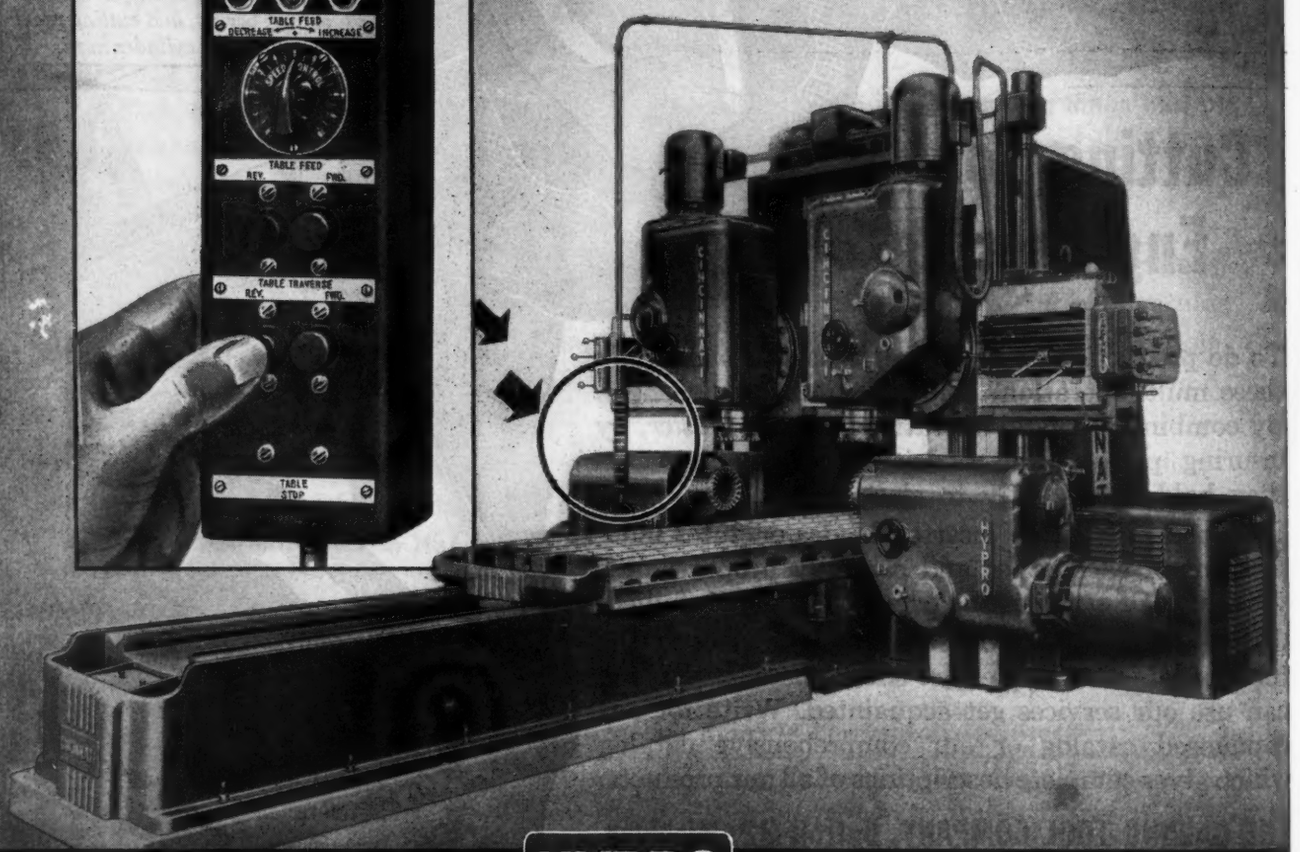
AN ENTIRELY **NEW** DEVELOPMENT...

Hypro-electronic

PLANER MILLER DRIVE



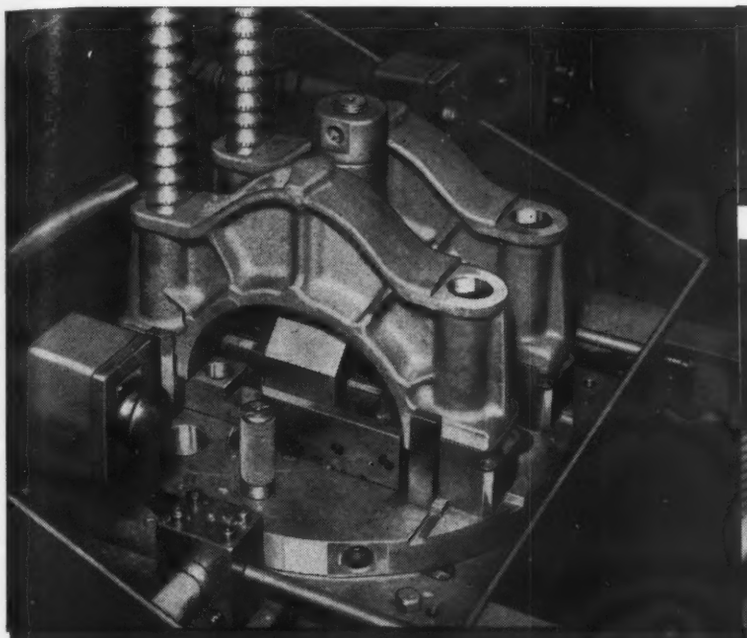
Operator starts and stops all feeds and rapid traverse. Also adjusts feed rates for all heads and table from pendant station. Eliminates all gears, clutches, and brakes.



THE CINCINNATI HYPRO PLANER COMPANY

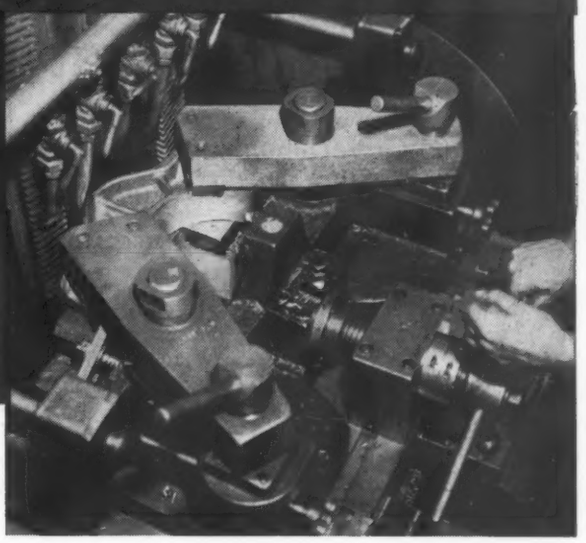
PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO



Finish broaching of four bolt holes (1-9/16" dia.) in two forged steel caps is done in less than a minute by Oilgear Vertical Pulldown Broaching . . . which proved faster and more accurate and eliminated defect-producing scratch marks.

3/16" of stock broached from two bolt bosses simultaneously on Oilgear Vertical Broaching machine which also broaches 1¼" stock from two lock-fit and joint-face surfaces measuring 2¾ x 2¾".



In removing metal and finishing surfaces such as these

. . . Oilgear broaching reduced operations and saved $3872.00 a month

How much can Oilgear Save for YOU?

The parts pictured in the two photographs shown above are main bearing cap forgings used in a well-known Diesel engine. Formerly, these forgings had to be milled . . . planed . . . hand-scraped . . . drilled . . . reamed . . . and bored before they were ready for assembly. Now, with Oilgear Broaching, the task is much simpler. Two bolt bosses, two bolt holes, lock-fits and joint-faces are rough and finished broached. That is all.

The consequences are amazing: More than $60 saved in direct costs for each set of bearing caps, an average of $3872 a month; an abrupt production jump; a far lower investment in equipment; lower tool cost per cap; closer machining tolerances for faster, easier assembly; better finish; less maintenance; less part distortion; less floor space; less power consumed. Oilgear Broaching may well do as much for you.

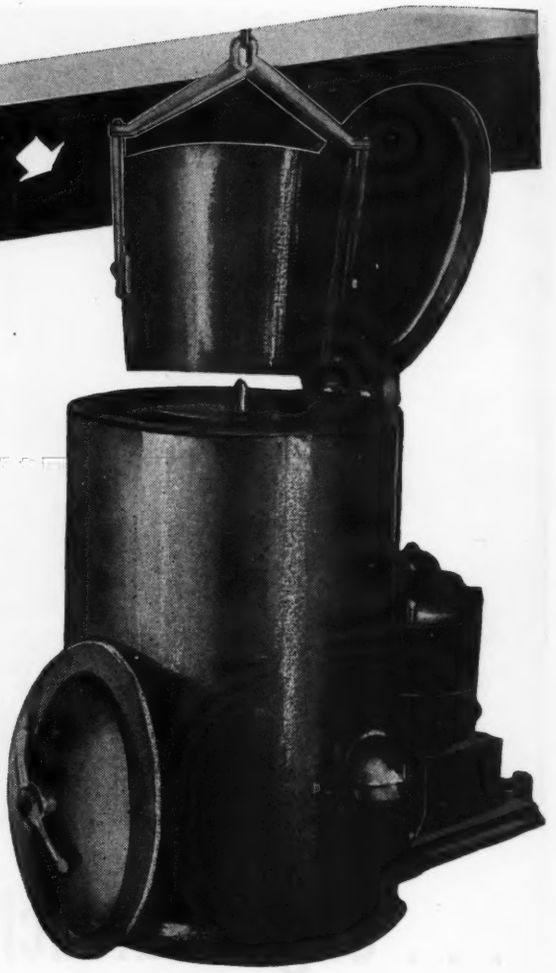
The time has come for every industrial executive again to take costs seriously. The time has come for every industrial executive to investigate Oilgear Fluid Power Broaching for the tremendous impact it can have on costs of every sort. Get the facts *NOW*. THE OILGEAR COMPANY, 1312 W. Bruce St., Milwaukee 4, Wisconsin.

OILGEAR BROACHING MACHINES

Oilgear manufactures a complete line of broaching machines . . . horizontal and vertical for every internal and external broaching operation. The superiority of Oilgear Broaching Machines results essentially from the recognized superiority of Oilgear Fluid Power. High broaching and return speeds are independently adjustable. Simple push-button controls provide manual, semi-automatic or full automatic operation. Machine, power system and tools are fully protected against overload. Power is consumed in proportion to speed and load only.

Oilgear Fluid Power

SALE . . .



CHIP OIL EXTRACTORS

And Other Government-owned Surplus Centrifugal and Separator Equipment

● CENTRIFUGALS ● SEPARATORS
● CHIP WRINGERS ● PURIFIERS—OIL ● CENTRIFUGAL FILTERS

When war shortages were even more critical than today, centrifugal equipment was widely installed to "prolong tool life", "conserve cutting oils", "save vital metals". Now the same benefits are equally important, if postwar production needs are to be met quickly. Fortunately surplus centrifugal equipment is available in quantity at sale prices in most W. A. A. regional offices. Makes and sizes are standard. Check this profit opportunity today. Fill in and mail the coupon below.

MAIL TODAY!

To War Assets Administration: I am interested in Chip Oil Extractors of the following makes and size or model No.

Make ..... Size or Model No. .....

.....

I am also interested in information on the following:

• Separators • Centrifugal filters • .....

• Oil Purifiers • ..... • .....

Name ..... Tel. No. .....

Firm .....

Address ..... State .....

City 468-1

EXTRA PROFITS FOR MAKERS AND DEALERS

Do you make or sell centrifugal equipment? If so, here is an opportunity to make a two-way profit.

You can buy this equipment—your own brand—on a where-is, as-is basis—recondition or redesign it faster than you can make or purchase new models—and resell it to your regular customers. They get needed equipment sooner. You gain their good will and extra profits besides.

To negotiate purchases of this type, simply write or phone your nearest W. A. A. office below.

VETERANS OF WORLD WAR II: This surplus property is being offered to prior claimants including veterans of World War II and to commercial dealers concurrently.

WAR ASSETS ADMINISTRATION

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cleveland • Dallas • Denver Detroit • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane Cincinnati • Fort Worth

Pat. &
Pat. Pending.

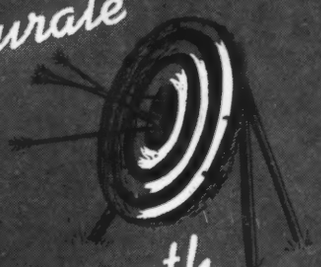
UNBRAKO

Reg. U. S. Pat. Off.

Holds Tight

Self-Locking

Accurate



Great strength and hardness

The "Unbrako" Socket Set Screw with the Knurled Cup-Point is a Self-Locker, because the knurled point digs-in and refuses to budge . . . regardless of the most chattering vibration! Yet, this screw can easily be backed-out with a wrench and used again and again. Made with the accuracy for which "Unbrako" products are famous; this "Unbrako" Socket Set Screw with Knurled Cup-Point is also outstanding for hardness and strength.

In sizes from No. 4 to 1½"; write for the free "Unbrako" Catalog. **"Unbrako" and "Hallowell" products are sold entirely through distributors.**

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 22 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

OVER 43 YEARS IN BUSINESS

SO SMOOTH AND STEADY...

you could dance a jig on it!

Fig. 732. Pat'd & Pats. Pend. Drawer is extra.

HALLOWELL

WORKBENCHES OF STEEL

Not that you would . . . but when you see how satisfied your employees are with such fine workbenches . . . and when you notice the long wear and exceptional service you're getting from the "Hallowell" workbenches of steel, you'll *feel like* dancing a jig on them! There are good reasons for this all-'round satisfaction, too . . . built sturdily, "Hallowell" benches stand firm and rigid, even when not bolted to the floor. Heavy pieces slide easily on those smooth steel tops and save workers from splinters. Available in about 1300 combinations, with legs coming in a number of different heights, it's easy to get the right bench for the job . . . ready-made! Write today for the "Hallowell" Catalog.

"Unbrako" and "Hallowell" products are sold entirely through distributors.

ARMY E NAVY

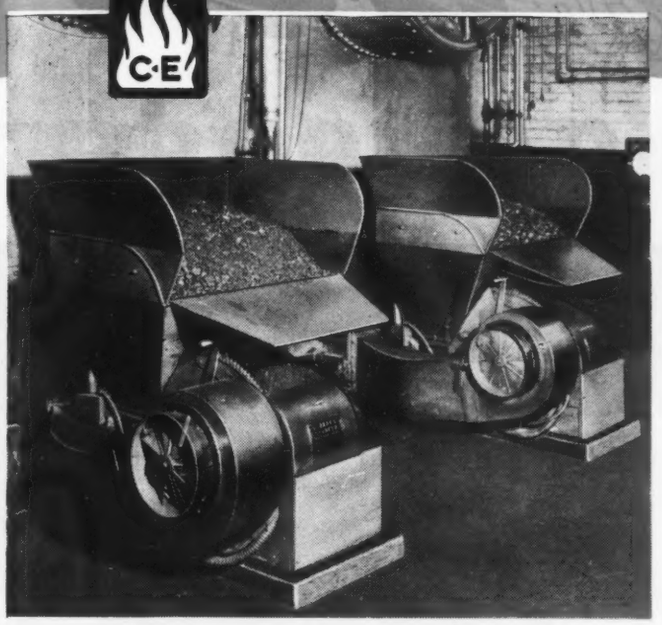
OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 22 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

Why COMBUSTION ENGINEERING CO., Inc. Equips Underfeed and Traveling Grate Stokers with

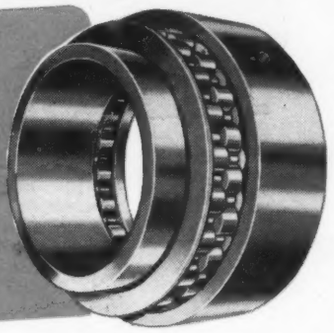
ORANGE ROLLER BEARINGS

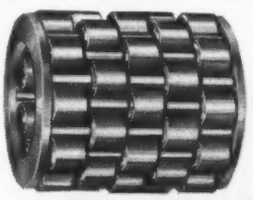


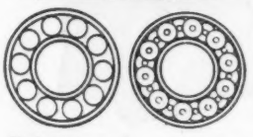
Combustion Engineering, another prominent user of Orange Roller Bushings *and* Orange Staggered Roller Bearings, writes, "In an emergency, when other sources of supply were unable to meet our requirements, we were able to obtain Orange Roller Bearings. We find that Orange Roller Bearing Company's delivery promises have been faithfully maintained, and the performance of the bearings is highly satisfactory."

Orange Bearings proved so satisfactory that today they are used in the driving mechanisms of C.E. Stokers of both underfeed and traveling grate types — in all sizes from 6 to 672 sq. ft. capacity.

ORANGE *STAGGERED* ROLLER BEARINGS





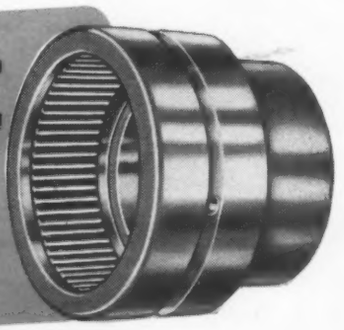


End views of a conventional roller bearing (left) and an Orange Staggered Roller Bearing. Note how staggered roller design provides a multiplicity of contact areas within the loaded zone.

Orange Staggered Roller Bearings combine great load carrying capacity in heavy operations with extremely smooth running in *precision* operations. They distribute the load over many short precision rolls — staggered to maintain roller alignment and to afford a multiplicity of contact areas within the loaded zone. Consequently, Orange Staggered Roller Bearings carry the same load as much larger conventional bearings — or conversely, have correspondingly greater capacity for a given size. They run smoothly and quietly, with exceptionally long life and freedom from trouble.

Made in a full range of standard *interchangeable* sizes — or special to your order. Write for Engineering Data Book.

ORANGE ROLLER BUSHINGS



Orange Roller Bushings are widely specified for their high load-carrying capacity, coupled with minimum space requirements.

Rigid standardization of dimensions permits much closer internal running clearances, maintaining true alignment of rollers with raceways. Exceptional standards of heat-treating, finishing and assembly are enforced. Ample overload capacity is designed into every bearing.

Orange Roller Bushings are made in a full range of types and sizes for easy incorporation in machine designs. Consult our engineering department for cooperation on bearing design problems. Send coupon for our Engineering Data Books. No obligation.

ORANGE ROLLER BEARING CO., INC.
552 Main Street, Orange, N. J.

—Mail Coupon for Engineering Data—

Orange Roller Bearing Co., Inc. M
Orange, New Jersey

Please send me your Roller Bushing and Staggered Roller Bearing Data Books.

NAME..... TITLE.....

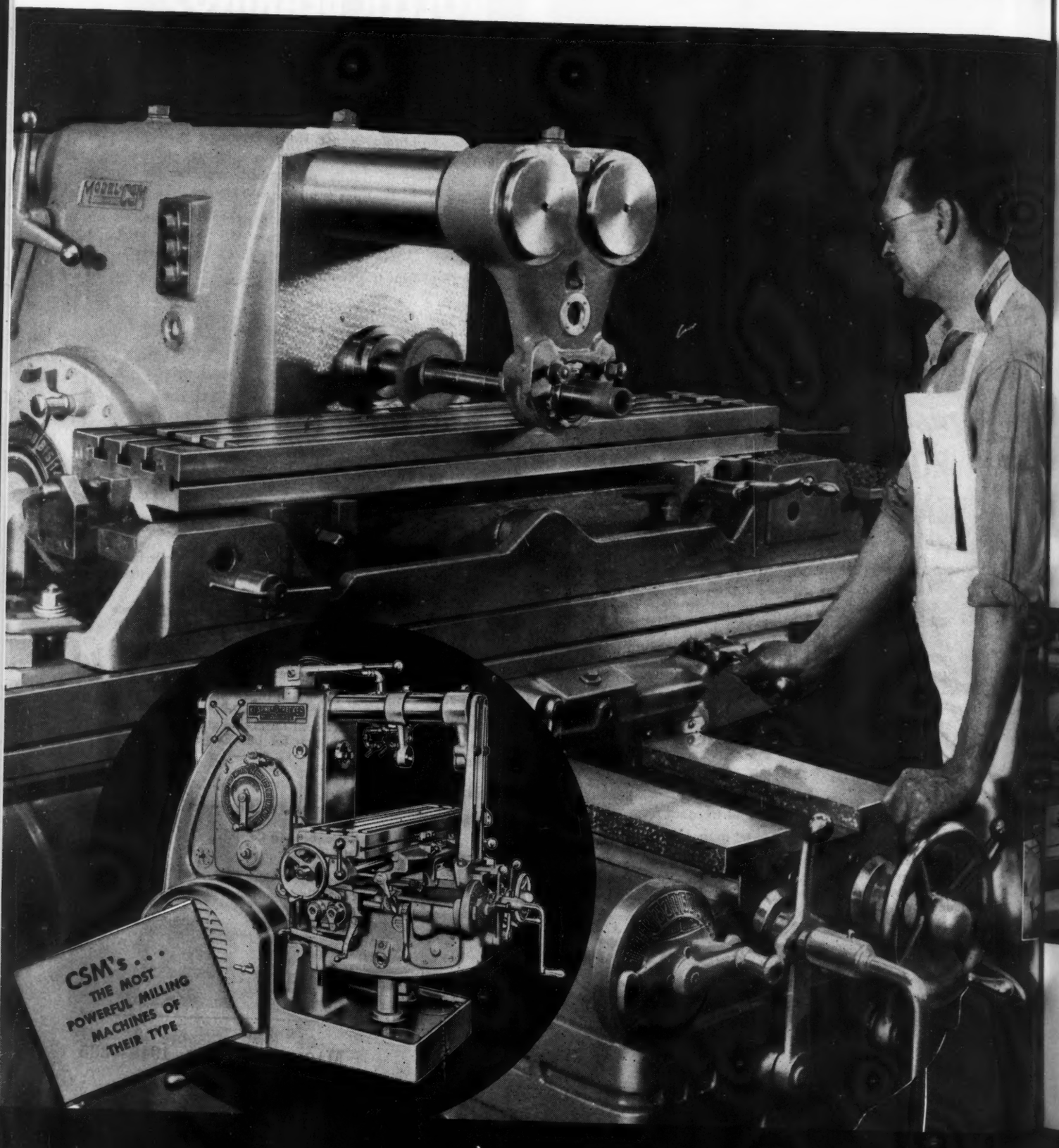
COMPANY.....

ADDRESS.....

CITY..... STATE.....

MILLING CAST IRON BUT

on a Standard



FAST!

Kearney & Trecker CSM

Kearney & Trecker CSM's are expressly designed for the the most efficient use of Carbide Cutters on ferrous and non-ferrous metals.

On this job, because of the size of the workpiece and fixture — we selected a 50 h.p. CSM plain model — and equipped with the proper cutter, it zipped through the cast iron workpiece easily and speedily. The details of the operation are given below:

OPERATION: Mill coolant trough
WORK PIECE: Milling machine table
MATERIAL: Close-grain, high-tensile cast iron
CUTTER: 6" dia., 10 tooth, carbide tipped slotting
CUTTER SPEED: 180 RPM
TABLE FEED: 21 IPM
DEPTH OF CUT: ¾" to 1¾" (3/32" — ¼" each side)
METAL REMOVAL RATE: 15 cu. in. per minute at maximum depth of cut.

NOTE the special fixture which provides maximum rigidity coupled with quick change set-ups on the workpiece and especially facilitates the loading and unloading of the workpiece on the machine.

• • •

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been developed after complete analyses of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards, and will cut metals faster and to finer tolerances and superior finishes than ever before, with high speed steel cutters as well as carbide cutters.

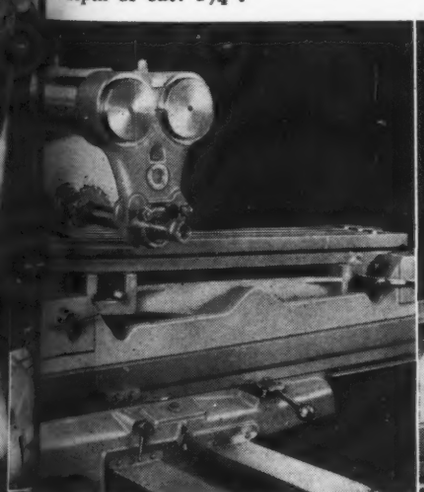
CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.

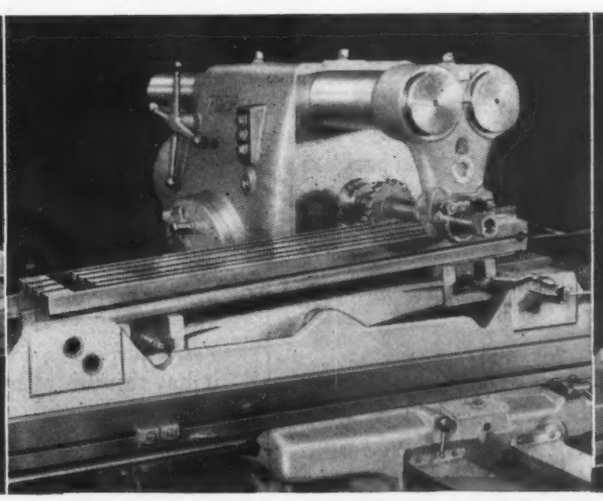
Write for complete data on CSM machines — CATALOG CSM-20. Please indicate your business connection.

Operation 1 . . .
Workpiece tilted to right in fixture. Angular coolant channel is climb milled. Maximum depth of cut: 1¾".

Operation 2 . . .
Workpiece tilted to left in fixture. Angular coolant channel conventional milled. Maximum depth of cut: 1¾".

Operation 3 . . .
Workpiece held in horizontal position in fixture. The two angular channels now blended by climb milling.





KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

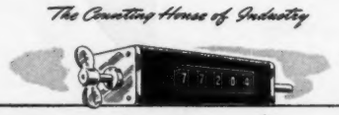
BE READY FOR TOMORROW . . . WITH CSM'S

"How many bales can a hay-baler bale... when a hay-baler's busy balin' hay?"

There's nothin' like a good old hot-stove argument in the winter time . . . but there's no time for it when you're hayin'! Thousands of farmers, and owners of hay-baling machines, know what we're talking about now. For on most of these machines is a corrosion-resistant Veeder-Root Counting Device that accurately records the number of bales wired up "from can-see to can't-see." So the farmer who hires the machine knows what he gets for his hire—and there's no room for argument on either side of the deal. Both parties have a cut-and-dried proposition (and *that* ain't hay). What's more, there's no problem with time-checking, or figuring out-of-service time.

Many types of farm equipment, from tractors to fruit-sorters and canning machines, have built-in Veeder-Root *Count*rol in many different forms, provided by many different types of Veeder-Root Devices. *Your* equipment, too, can profit you more if it has this added utility . . . this proof of performance and guarantee . . . this protection against all the errors that creep in where there's guesswork. Write, and find out what *Count*rol can do for *you*.

The Counting House of Industry

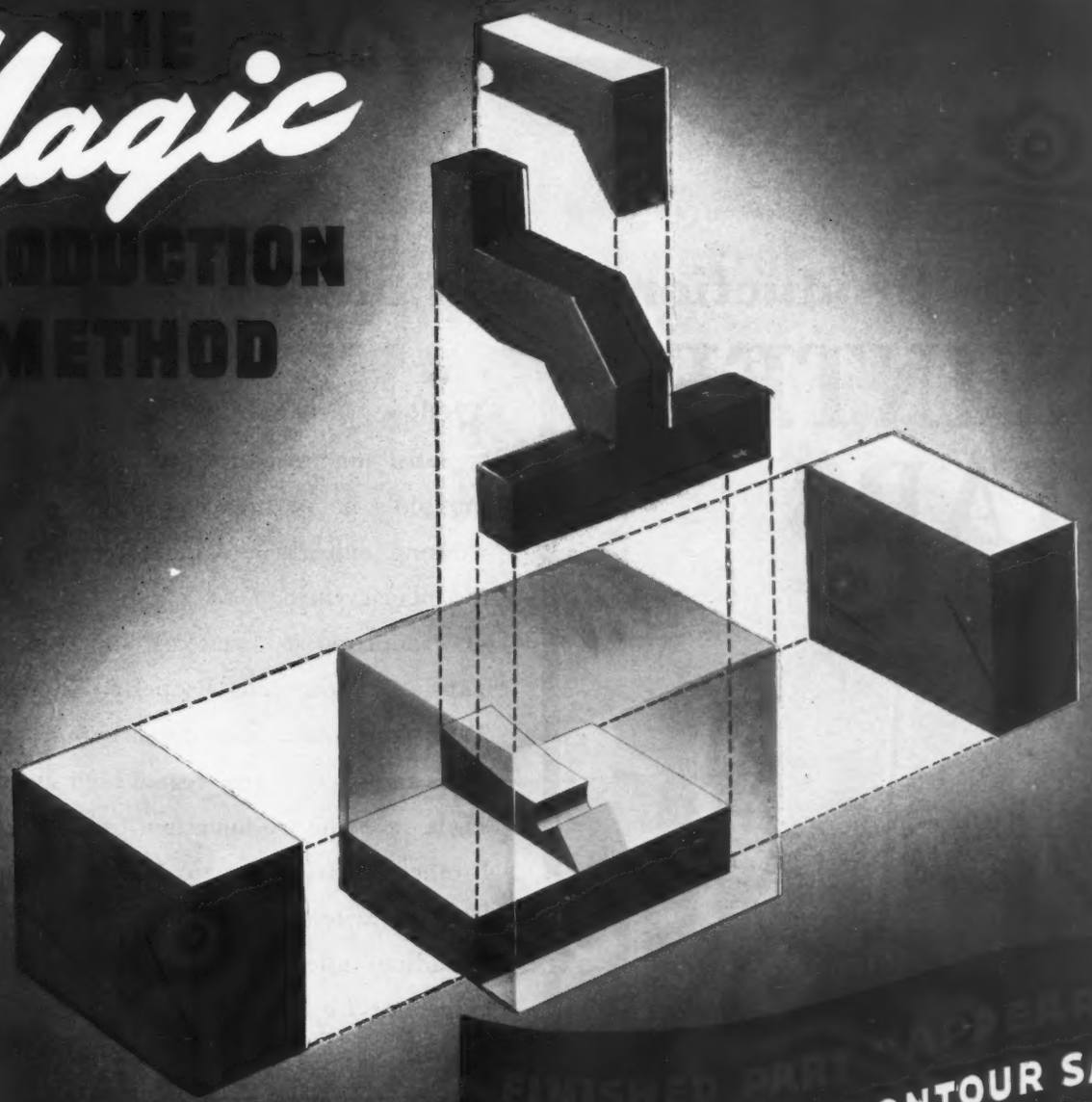


VEEDER-ROOT INC.

Hartford 2, Connecticut

***In Canada*: Veeder-Root of Canada, Ltd., Montreal**
***In England*: Veeder-Root Ltd. (New address on request)**

THE Magic PRODUCTION METHOD



CONTOUR SAWING

Contour Sawing is the *world's fastest metal removing process.* Hundreds of sharp, hard tool points on endless band "slice" off unneeded metal — no slow "whittling" to worthless chips. Continuous cutting; no backstroke or lost motion. Apprentice can cut accurately within .005".

Above 3-dimensional part, contour-sawed on a DoALL by Royal Typewriter Co. Hartford, Conn. Countless other jobs are similarly produced from stock instead of being cast or forged and machined by ordinary methods. All metals, even tough alloy steels, a foot or more thick, are precision cut on a Contour Saw.

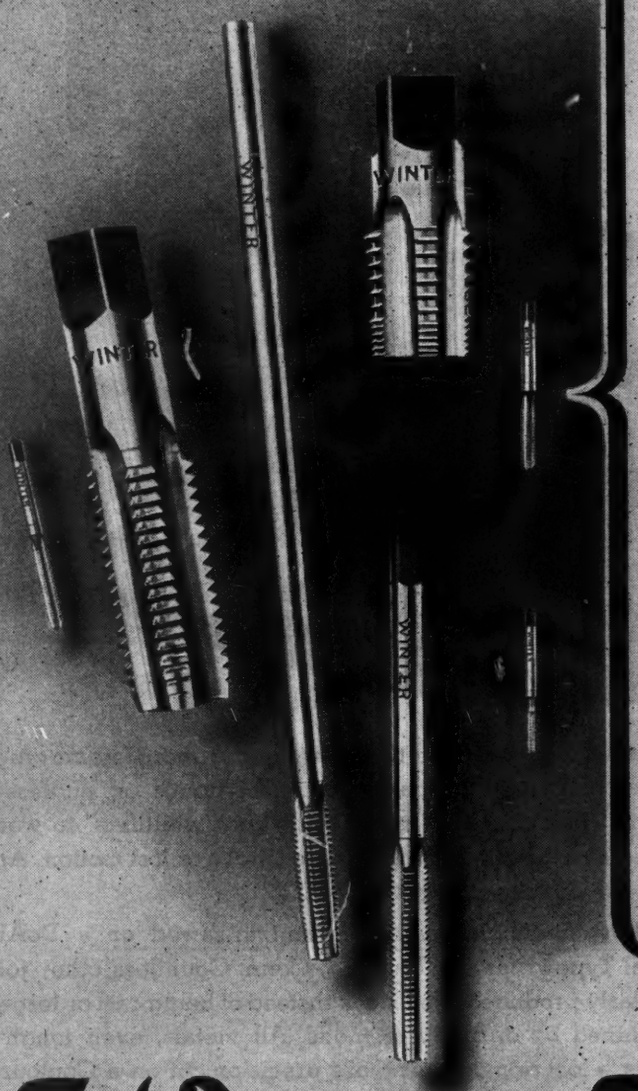
Amazing advantages of Contour Sawing are pictured in free booklet *"DoALL Equals Ten Plus"*. Write for a copy to find out about real production economies.

The DoALL Company

DoALL STORES
IN PRINCIPAL CITIES

MACHINE-TOOL DIVISION
MINNEAPOLIS 4, MINN.

WHY
Your Production Set-up Should Include
WINTER TAPS



FOR 45 years Winter Taps have been satisfying a need for precision threading tools in all branches of the metal working industry and more recently in the plastics field.

Production at lowest cost and Winter Taps are synonymous. Properly designed Taps, controlled manufacturing tolerances and scientifically treated high speed steels, are the culmination of Winter Brothers untiring research and constant laboratory testing, resulting in closer threading tolerances, cleaner threads, longer service between grinds and *extra tap life.*

You get more production at lowest tap cost from Winter Taps. Specify them — always!

• • •

For that troublesome tapping job, Winter Brothers "result getting" Service Engineers can prove highly valuable to you as a user of Winter Taps. Maintained to help you to more economical threading.

Winter Brothers
COMPANY
Wrentham, Massachusetts, U.S.A.

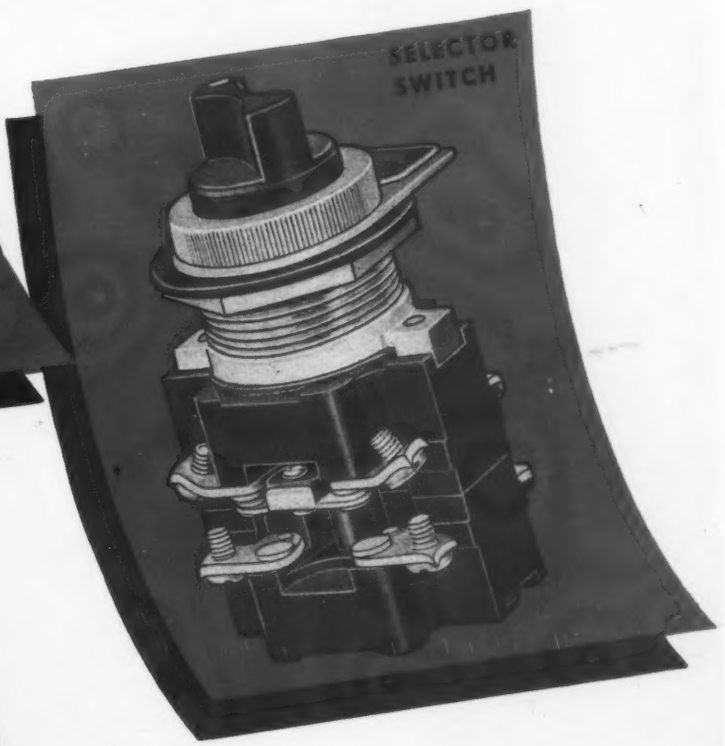
BRANCH STORES: SAN FRANCISCO, CALIFORNIA · CHICAGO, ILLINOIS · DETROIT, MICHIGAN

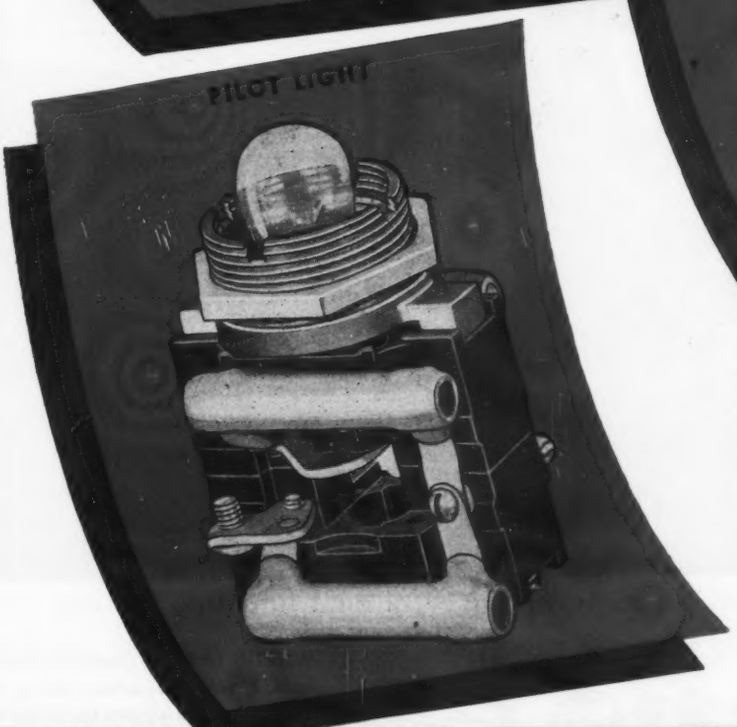
A DIVISION OF THE NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICHIGAN

Another "3C" Achievement!

PERMANENTLY OIL TIGHT PUSH BUTTON, PILOT LIGHTS *and* SELECTOR SWITCHES *for use on Machine Tools*

Now you can avoid fouling contacts from seepage of oil or cutting compounds with these new "3C" developed Push Button Elements, Pilot Lights and Selector Switches that are *entirely oil tight.* A steel faced oil-tight washer is held snugly against both front and rear of the panel by close fitting nuts. An oil-tight boot closely grips the button, effectively sealing it against leakage.





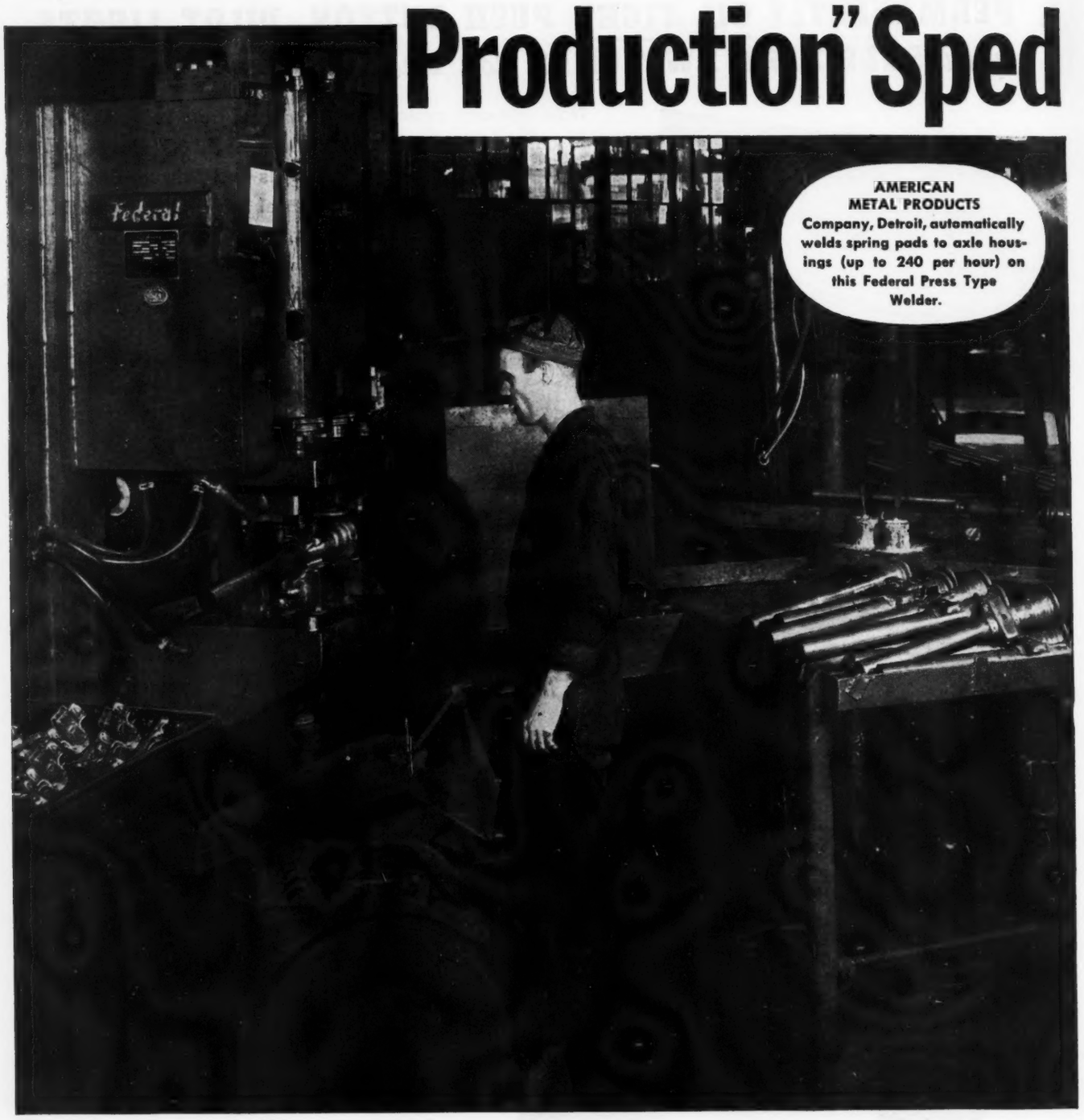
These heavy-duty Type DO units have the same basic elements as the "3C" Type "D" units which have established such excellent records in heavy-duty use. Push Buttons and Selector Switches feature Silver-to-Silver Double Break Contacts. All units have large, easily accessible terminals that simplify wiring. Selector Switch permits 2 or 3 position operation. Vertical mounting is standard, but all units are adaptable to horizontal mounting. Mushroom head available for Push Button. Color caps for Pilot Lights are available in Red, Green, Amber, Blue, Clear and White.

Write for full information.

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

Auto Industry Has Many Production" Sped



AMERICAN METAL PRODUCTS Company, Detroit, automatically welds spring pads to axle housings (up to 240 per hour) on this Federal Press Type Welder.

THE Federal MACHINE

BULLETIN SP 346—Describing Federal Spot, Flash, Projection, Seam and "Gun" Welders is yours for the asking.

SUBSIDIARIES
Sommer and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES
The Warren City Mfg. Co., Warren—WARCO PRESSES and PRESS BRAKES

Examples of "Necessities by Federal RESISTANCE WELDERS

For instance, you can take a heavy-gauge steel tube like this, which is a rear axle housing component, and a heavy-gauge stamping like this, which is a spring pad; insert them in a Federal PA-4 Press Type Welder with simple dies (shown left) and they come out as though one piece of metal . . . but stronger. Fifteen seconds total time. That's four pieces a minute.

Note the three nubs projecting inwardly on each side of the saddle portion of the stamping. At these points of contact between stamping and tube, welds initiate. Under heat and pressure the parts are forged together in these areas, the junctures becoming stronger than surrounding parent metal.

To the vast saving of time, against previous joining methods, add time savings on final assemblies and great economy in material, resulting from this design. (Heavy castings were used where lighter but tougher stampings now do the job).

There you find the reasons why industries noted for making the most of needed goods at the lowest cost are largest users of Federal Resistance Welders.

This is typical of hundreds of Federal welded jobs produced by the American Metal Products Company of Detroit, makers of quality parts for many industries. It is typical too, of thousands of other production-speeding, cost cutting methods possible with Federal Resistance Welders.

Every delay of full-scale production for the dammed-up needs of world markets through shortages of material or of work makes the need for eventual production speed more important . . . lowering of unit costs more urgent. When you find out (through the Federal Engineering Service nearest you) how you can cut cost and time in YOUR production with automatic welding, be sure that you get Resistance Welders by Federal.

APPLIANCES

RADIO PARTS

ACCESSORIES

UTENSILS

PRODUCTION SHORT CUTS

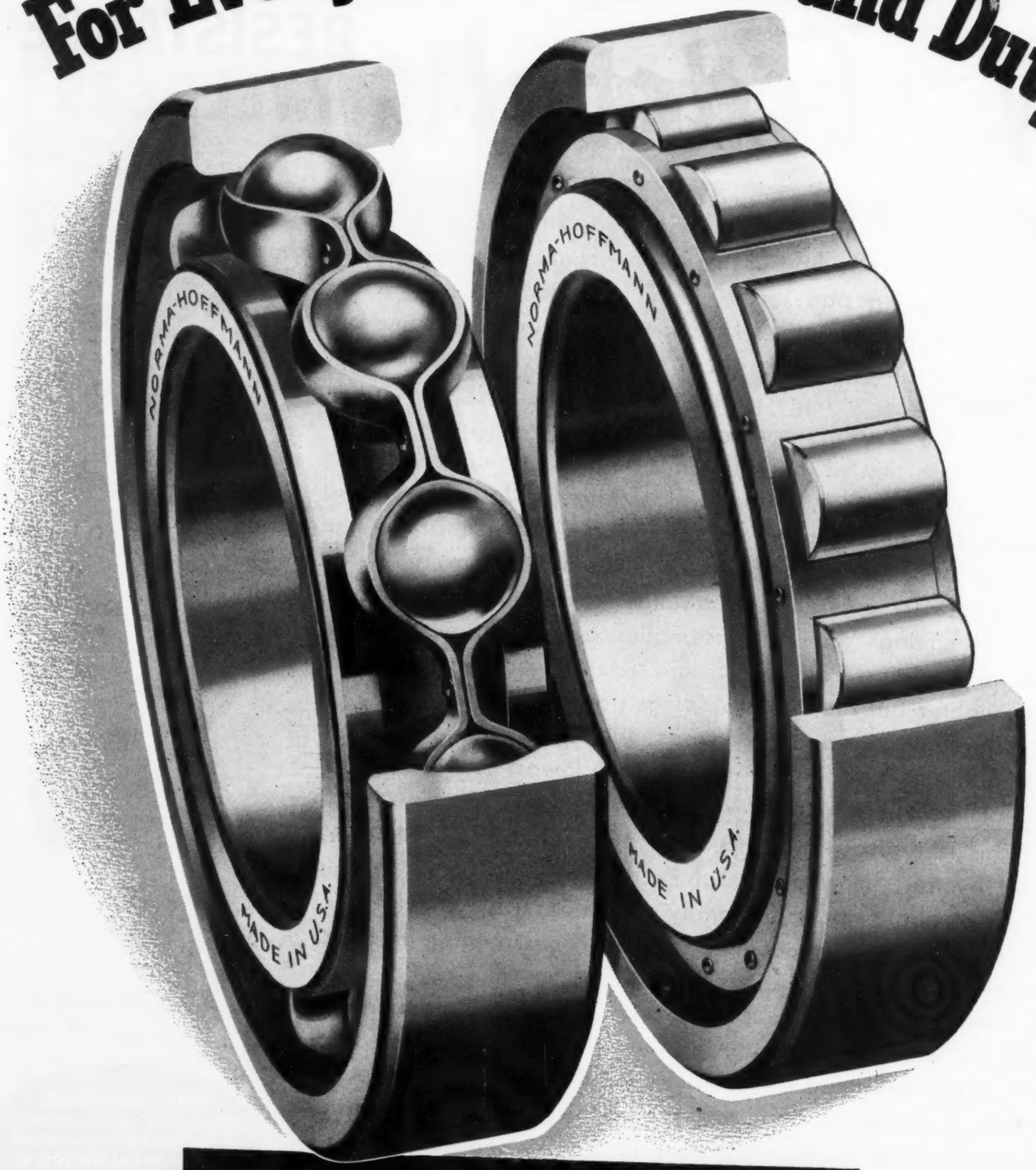
PROJECTION WELDED
Thousands of variations of the typical items above are produced at low cost on Federal Welders described in Bulletin 4520

AND WELDER COMPANY

MEMBER RESISTANCE WELDER MANUFACTURERS ASSOCIATION RWMA

208 DANA STREET • WARREN, OHIO

For Every Load, Speed and Duty



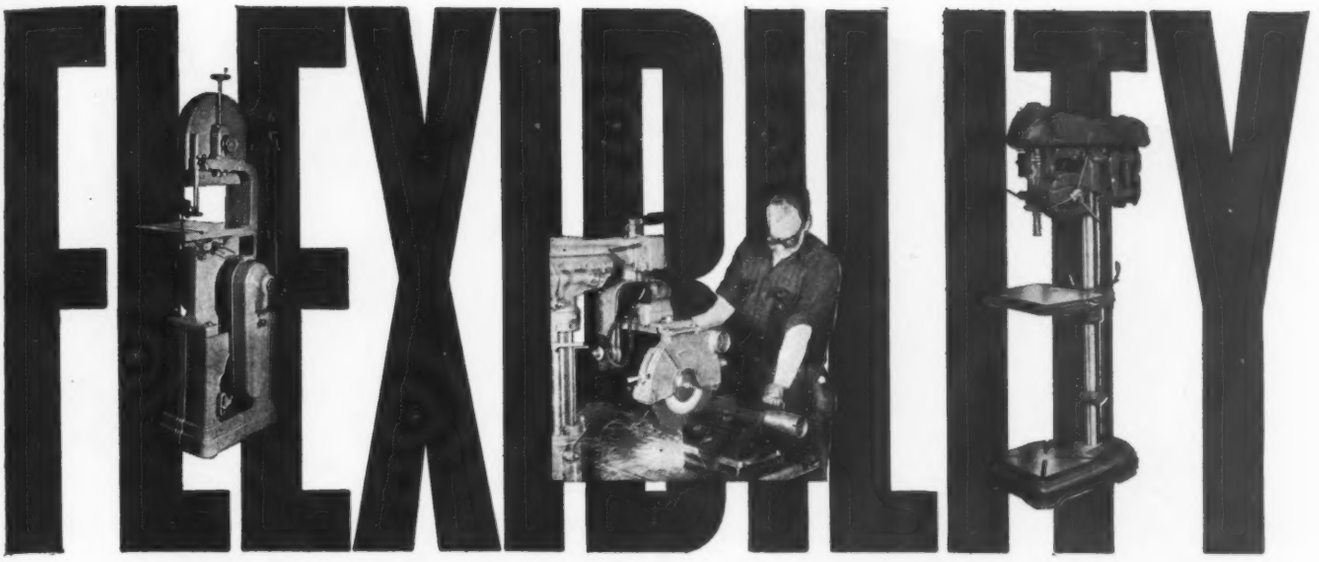
"NORMA-HOFFMANN"

Precision Bearings

BALL, ROLLER, THRUST—3000 SIZES

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONNECTICUT

FLEXIBILITY



A BIG WORD IN PRODUCTION MANAGEMENT

DRILL PRESSES

RADIAL DRILLS

RADIAL CUT-OFFS

BAND SAWS

GRINDERS

New products should mean new tools—the plant equipped with modern, flexible, highly efficient machine tools will have the jump on manufacturers using equipment and methods that are obsolescent.

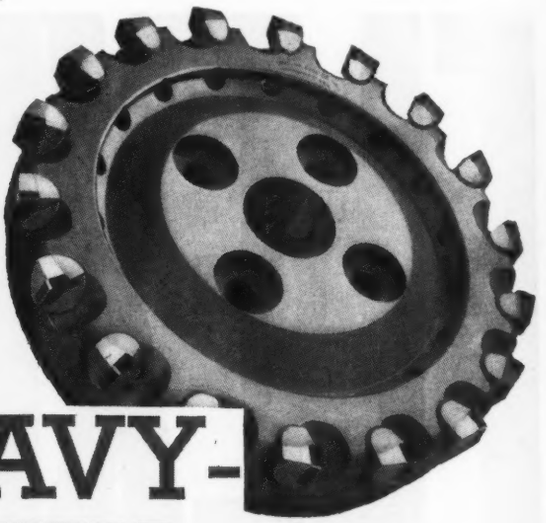
At relatively small cost almost any plant can improve its manufacturing processes **and keep those processes flexible** by re-tooling with Walker-Turner light Machine Tools.

Flexibility is ensured—not only because each unit costs little and can be moved, set aside or even scrapped when its work is done, without financial hardship—but because each machine has a wide range of performance in speeds, spindle travel and size of work accommodated with full visibility and efficient operation. A Walker-Turner equipped shop can change its production set-up over a weekend at little or no cost.

And it won't be a compromise, for these machines were operated on 24 hour-day schedules throughout the war years. They are now being ordered in thousands of plants for in-the-line production wherever metals, wood and plastics are drilled, cut or shaped.

Management is realizing that its past "investment" in machine tools which have become obsolete can be profitably written off with replacements of light, highly productive Walker-Turner Machine Tools. A complete catalog will be sent on request.

SOLD ONLY BY AUTHORIZED INDUSTRIAL MACHINERY DISTRIBUTORS



HEAVY-DUTY *for* CAPACITY PRODUCTION

THE TYPE "H" FACE MILLING CUTTER

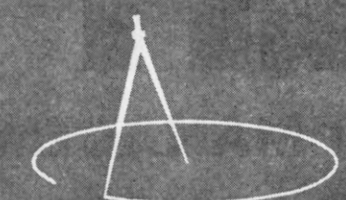
When the job is face milling—at capacity production—call on a Lovejoy Type "H" Face Milling Cutter to take the fullest advantage of modern improvements in machines, alloy tips, and metal-removing techniques.

It's a heavy-duty mill—designed for $\frac{3}{4}$" depth of cut. That's the reason for the husky, rugged build—the tough, forged-steel body—the heavy **one-inch** blades—the solid backing of the blades—the generous chip clearance.

This rigidity and compactness is completed by the method of holding the blades in the body: Lovejoy's famous **positive-locking** device. This means that even heavy intermittent cuts cannot loosen the blades. It also means that the blades can be moved up—in the line of wear—until **all** of the extra large carbide tips are used up.

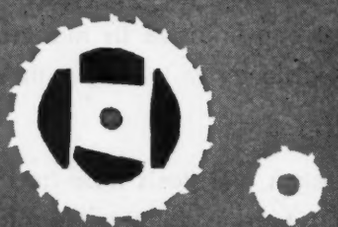
All blades are accurately machined for interchangeability, and all blades for Type "H" cutters can be interchanged throughout the complete range of sizes (6 to 24 inches dia.).

The Type "H" is being used for negative-rake milling with complete success. It is available for any type of drive or mounting—and with either HSS, cast alloy, or carbide-tipped blades. Write for further information.



DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.



RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

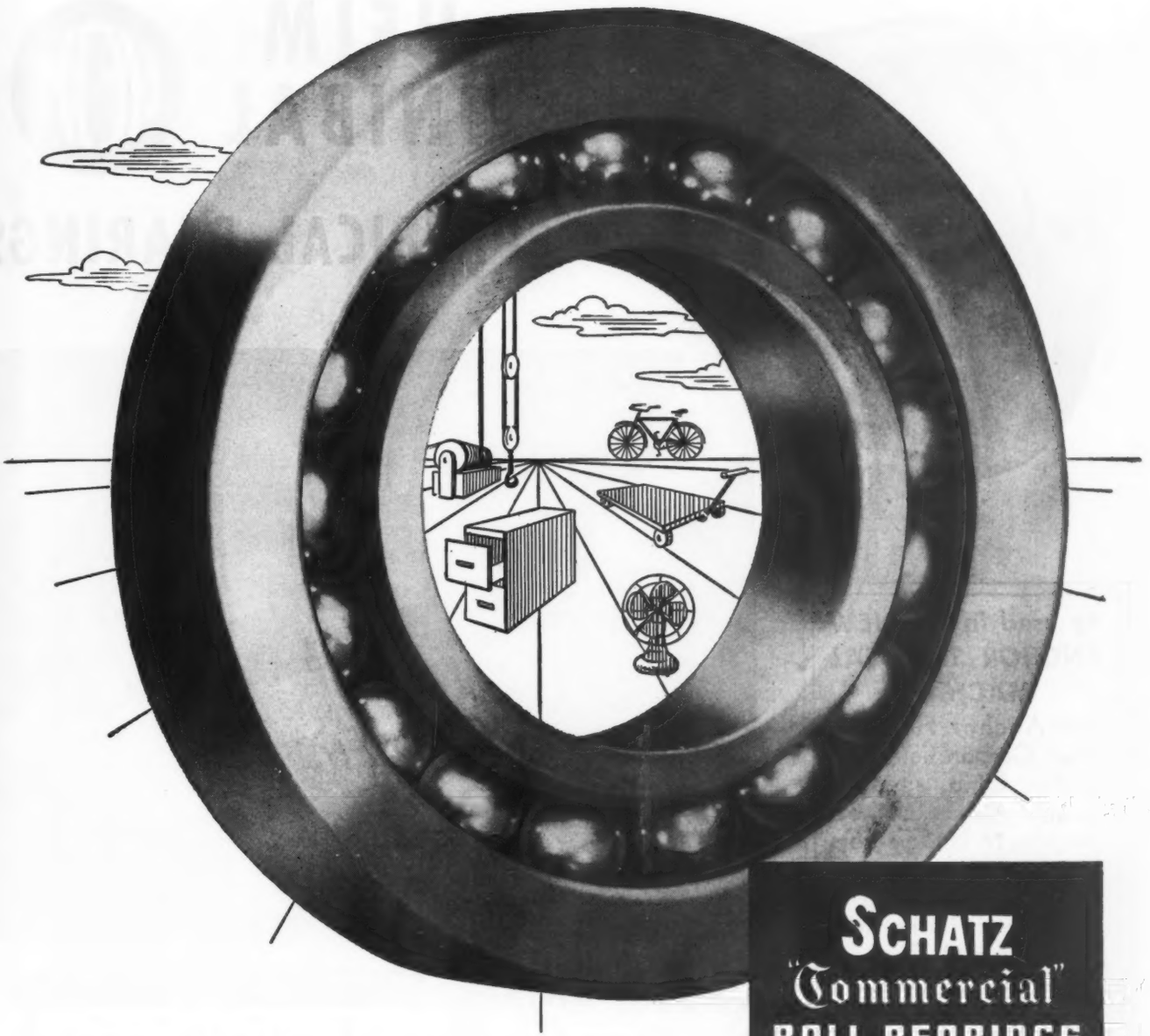
SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A.—there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.



The low-cost, multi-purpose ball bearing

You name the product...hand truck, electric fan, file cabinet, bicycle, or *any* application where friction-free operation must be combined with low initial cost. That's the job for Schatz "Commercial" Ball Bearings.

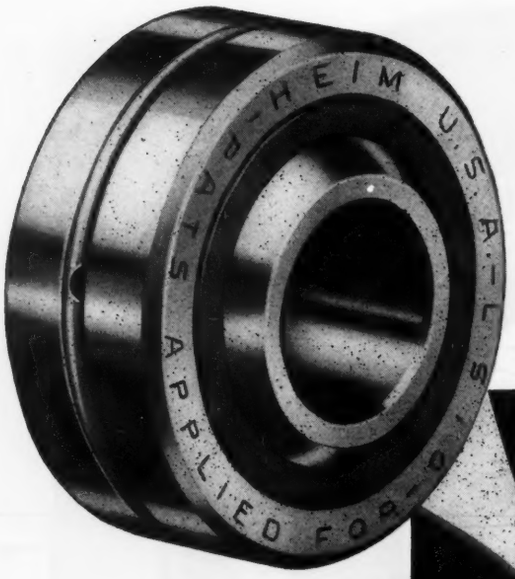
How do "Commercials" differ from other low cost ball bearings? High-grade, low-carbon, cold-rolled steel rings is one way. Through-hardened precision balls is another. The combination strengthens their capacity to take on the heavier loads, and results in longer bearing life and all-around utility...whatever the service requirements.

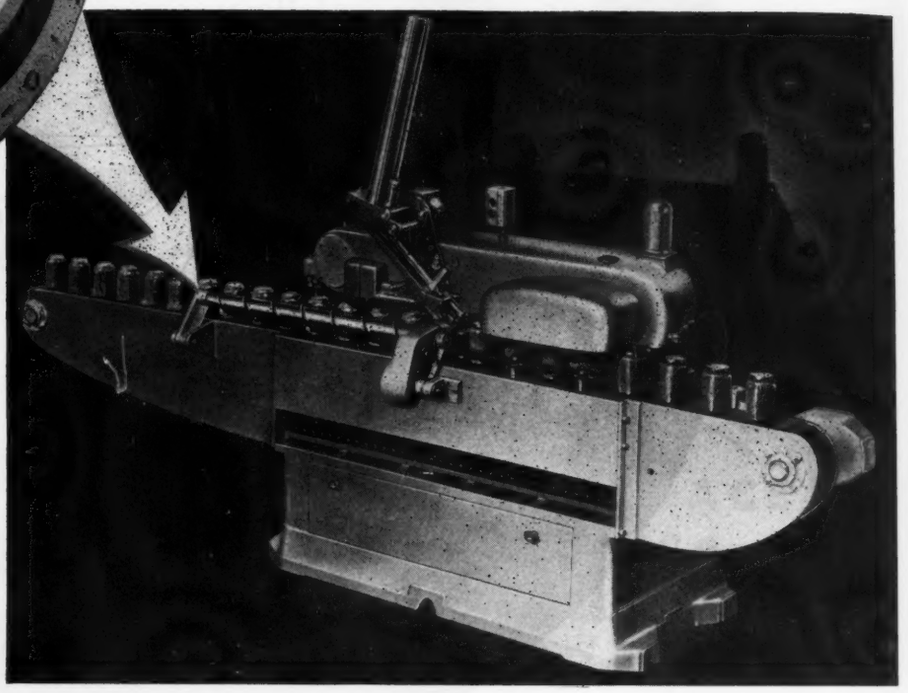
"Commercial" Ball Bearings are manufactured in every standard type and size. The common denominator in each is the half-century of Schatz manufacturing experience, plus the engineering counsel that's ready to lend a knowing hand in fitting the right bearing to your problem.

Remember, Schatz makes only ball bearings, and "Commercials" are manufactured only by Schatz.

THE SCHATZ MANUFACTURING COMPANY
POUGHKEEPSIE, NEW YORK
REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
Chicago: 8 S. Michigan Ave.—3 • Los Angeles: 5410 Wilshire Blvd.—36

HEIM UNIBAL SPHERICAL BEARINGS





As used in the NEW ANCHOR STERISEAL MACHINE

The Anchor Hocking Glass Corporation, Lancaster, Ohio, supplies the new Anchor Steriseal Machine to food packers for high production steam vacuum sealing of glass containers with Anchor AH-N Caps. A small, but important part of this machine is the Heim Unibal Spherical Bearing used to support one end of the Helicoid Timer.

HEIM also makes UNIBAL ROD ENDS

HEIM UNIBAL SPHERICAL BEARINGS

for correction of misalignment

Developed during the war for exclusive use in airplane construction, the unusual principle used in making the Heim Unibal Spherical Bearing is meeting with enthusiastic approval by American Industry in general. Using only one ball instead of a double row of balls in a race, a greater surface supporting area is presented and heavier loads can be carried without breakage. Longer life at lower initial cost, coupled with the self aligning feature of this new type of bearing make it a must for today's production needs.

PLEASE WRITE FOR CATALOG NO. 11

THE HEIM COMPANY
FAIRFIELD CONNECTICUT

Over 100 Products to Help Machinery Serve Better!

IDEAL "first Assistants" In Modern Machine Shops!

Pictured above; (1) LIVE CENTERS, help speed production by making it possible to turn heavier loads, take deeper cuts, at higher speeds. (2) ELECTRIC TACHOMETERS, a new step in accurate machine speed measurement. (3) GRANITE SURFACE PLATE, for absolute accuracy to .0001 inch when laying out drill jigs, dies and fixtures. (4) DEMAGNETIZERS, remove metallic dust, flakes, fine chips, from tools, finished parts, etc. (5) GRINDING WHEEL DRESSERS, true and clean surfaces of grinding wheels. (6) BALANCING WAYS, improved model for static balancing, straightening, truing operations. (7) "MACHINE SHOP" METAL ETCHER, marks all smooth-surfaced iron and steel *permanently.*

These are only a few of the IDEAL line of production-speeding, money-saving equipment that includes over *100 products* serving more than *40,000 customers* through *200* IDEAL *Service Engineers.* Stocks carried at the factory, in warehouses, and with wholesalers in all principal cities. ***Ask for FREE 88-page Handbook.***

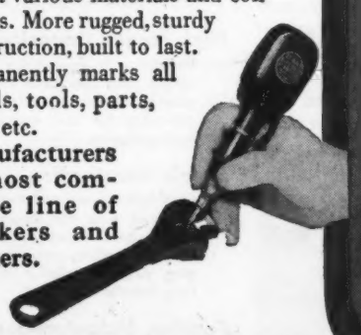
ANNOUNCING

New, *Improved*

IDEAL *Electric* MARKER

This brand new, streamlined marker is full of improvements that make permanent marking on all materials easier and faster than ever before—Lighter weight and better balanced. 30% more power. Marking Stroke adjustable to suit various materials and conditions. More rugged, sturdy construction, built to last. Permanently marks all metals, tools, parts, dies, etc.

Manufacturers of most complete line of Markers and Etchers.



PROMPT DELIVERY

1165

Machinery Products Division

IDEAL INDUSTRIES, Inc.

(Successor to Ideal Commutator Dresser Co.)

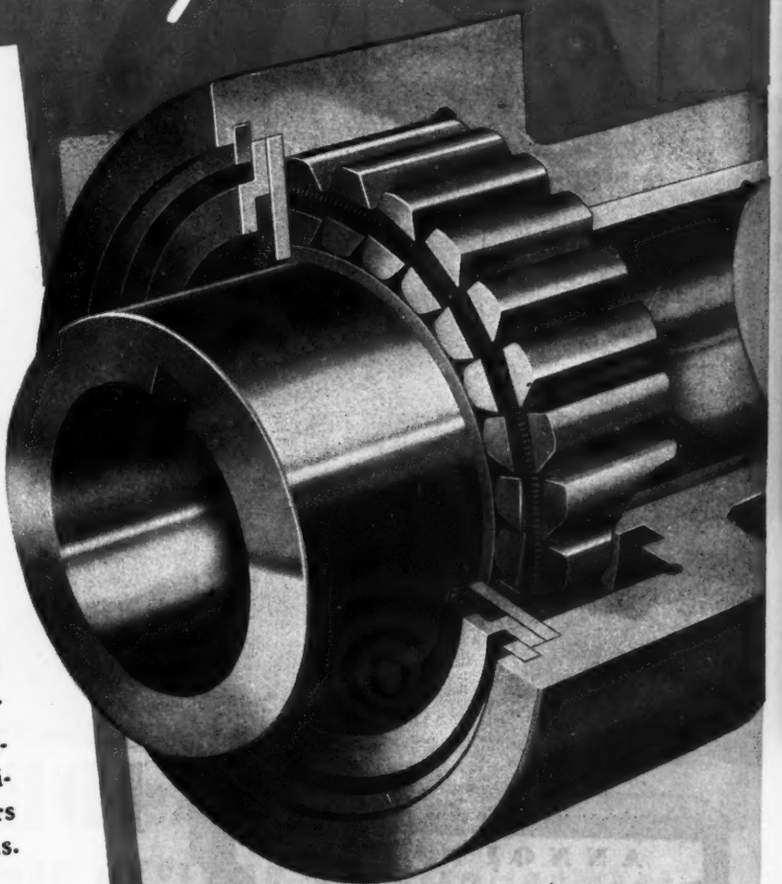
1011 PARK AVENUE SYCAMORE, ILLINOIS

Branch offices in principal cities • Consult your local telephone book

FORMSPRAG

THE FULL COMPLEMENT

Over-Running Clutch



Outstanding Performance in Many Lines of Industry

The operation of Formsprag in service has demonstrated its worth wherever there is need for positive, precision performance.

It has been time-tested, and enthusiastic reports accompanied by repeat orders have been received from the manufacturers of box making machines, bread wrapping machines, printing presses, spring coilers, dual power drives, punch press feeds, textile weaving machines, paper and rubber calenders and machine tools.

A standardized line meets most requirements, but where special applications are necessary our engineers are ready to make recommendations.

WRITE For Literature

Give full information—a description of the operation, normal and maximum torque at specified speeds, the number of times per minute the clutch engages and disengages, and other pertinent information.

Formsprag Design Insures SUPERIOR PERFORMANCE

The performance of FORMSPRAG, in widely diversified industries, offers testimony to Gear-grind's sound engineering, precision manufacture and proper application.

Full Complement of Sprags

With the annular space between driving and driven members completely filled with sprags, there is no need for cages to position them. Torque load is distributed over the greatest possible number of sprags. Longer life is the result.

High Torque Capacity

Formsprag is available in many sizes, providing torque load capacities from 20 to 10,250 foot pounds. Formsprag offers the highest possible capacities for size, weight and space required for installation.

Simple Construction

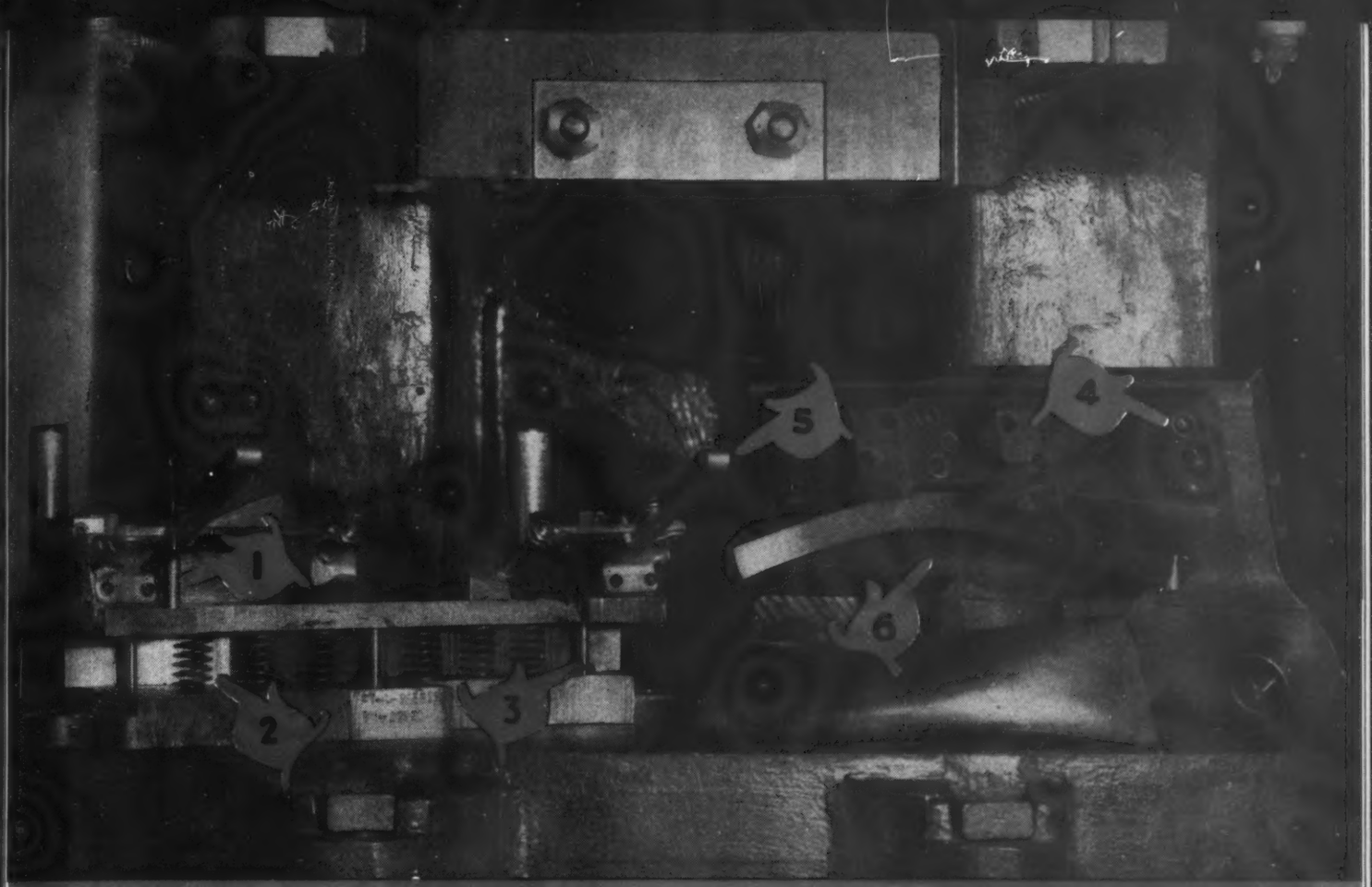
Cylindrical inner and outer races on which no localized wear can develop. No internal or external cams. No cages. End notches shaped to retain energizing spring and protect sprag gripping surfaces against concentrated end load. Easy installation.

Positive, Instantaneous Action

No lost motion. No backlash. No slipping. Over-runs freely, at the slightest reduction in the speed of the driving member. Engages smoothly and positively.

The GEAR GRINDING MACHINE COMPANY

DETROIT 11, MICH. U.S.A.



THE 6 DANLY PRODUCTS IN THIS PICTURE

FIT INTO MANY PLACES IN YOUR PICTURE

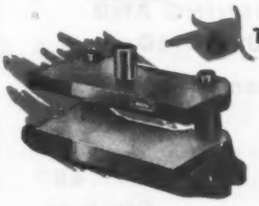
DANLY PRECISION DOWEL PINS have a big job to do in the Steel, Non-ferrous metals and Plastic Industries. Accurate through their length, there will be no expensive re-drilling and reaming, because Danly Precision Dowel Pins are diamond tested for hardness and ground to a tolerance of one-ten thousandth of an inch . . .

DANLY DIE SPRINGS are noted for *staying power*. The repeated pressure of the ram many times every hour induces fatigue that will snap ordinary die springs—and that means tearing down the whole setup. Two complete lines. *MEDIUM PRESSURE—HIGH DEFLECTION; HIGH PRESSURE—MEDIUM DEFLECTION.*

DANLY SOCKET-HEAD STRIPPER BOLTS incorporate the same advantages as the Danly Knurled Socket-Head Cap Screws. Busy fingers don't slip on the knurled head . . .

DANLY KNURLED SOCKET-HEAD CAP SCREWS save time and money. Here's why: Oily fingers readily grasp the knurled head—the mechanic can drive it a good part of the way by hand before using the wrench. Infinite applications—a wide range of sizes . . .

DANLY KWIK-KLAMP TOGGLE CLAMPS are versatile, all-around utility clamping tools. Strong construction combined with simplicity of operation makes Kwik-Klamps a must wherever quick, positive clamping action and known pressures are desired . . .



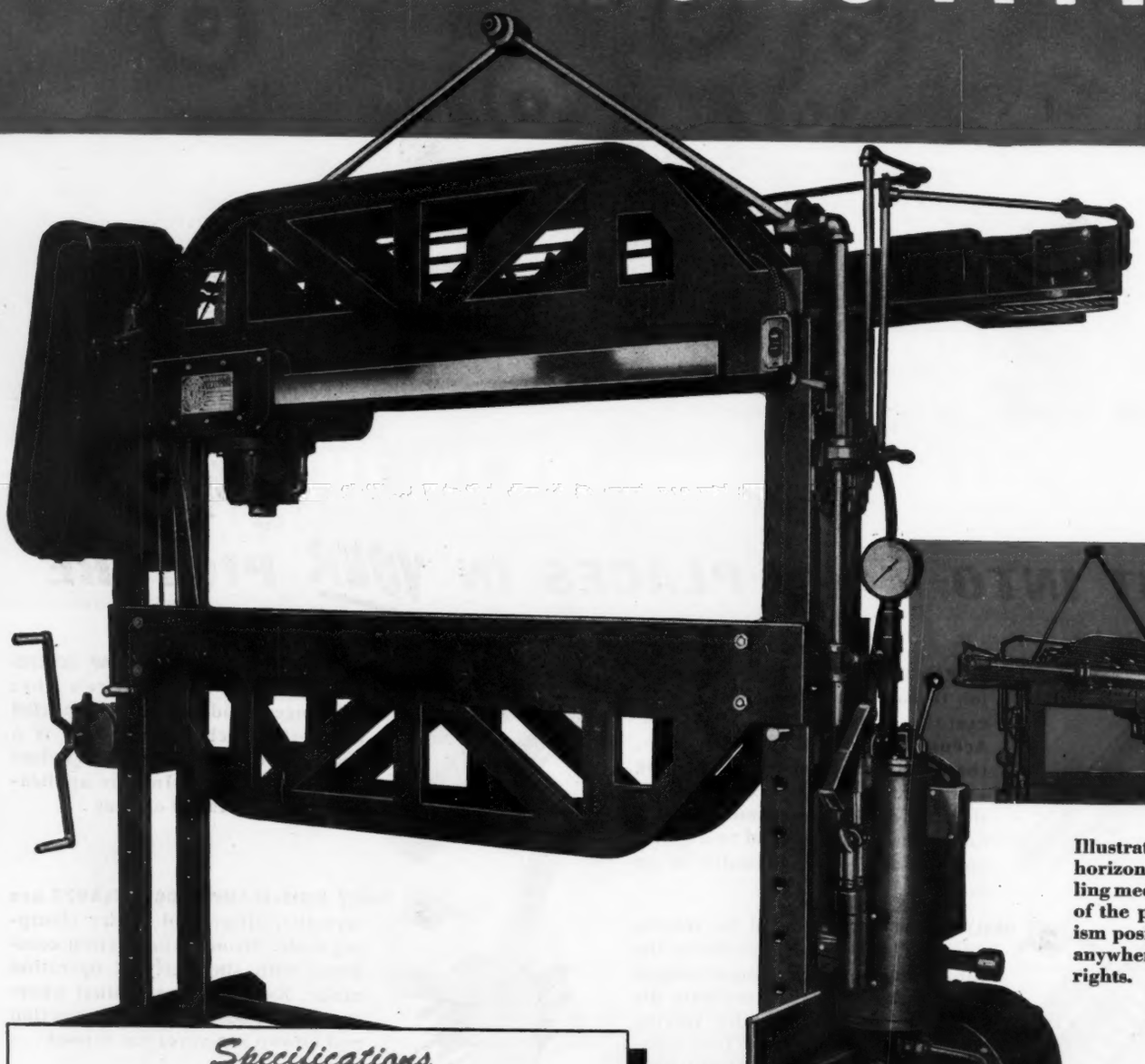
THE DANLY DIE SET needs no introduction. A *must* for precision stamping, Danly die sets are once more paving the way to that new washing machine and electric iron in every home—that new car in every garage . . .

Branches and Dealers in Principal Cities

DANLY MACHINE SPECIALTIES, INC. ARMY E NAVY **2112 So. 52nd Ave., Chicago 50, Ill.**

Danly Tool, Die and Gage Makers' Supplies

"ENGINEERING VISION OF OUR SONS... NOT



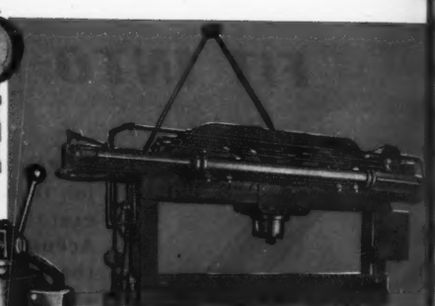


Illustration above shows the horizontal ram head traveling mechanism on the back of the press. This mechanism positions the ram head anywhere between the uprights.

Specifications

OF BENDING, STRAIGHTENING AND FORMING PRESS ILLUSTRATED

Opening between Upright Members	72"
Maximum Daylight	35"
Minimum Daylight	4"
Cylinder Travel Laterally	48"
Ram Speed Laterally	90"/min.
Ram Travel	7½"
Ram Speed Horizontally	15"/min.
Overall Height	100"
Overall Width	108"
Weight	3700#

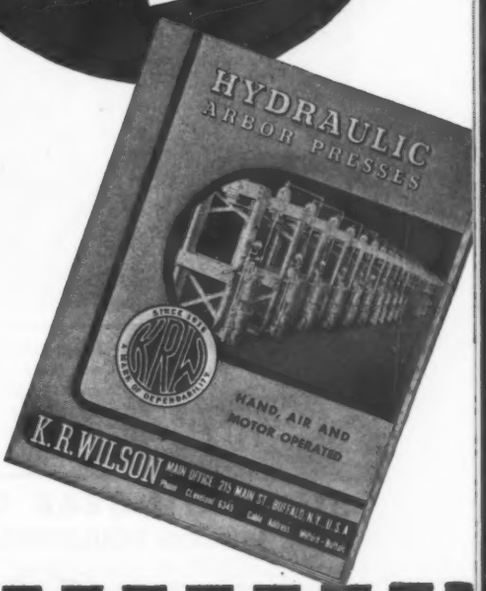
THAT MEETS THE NEEDS OF OUR GRANDFATHERS"

K. R. Wilson

NEW KRW SHEET STRAIGHTENING PRESS SAVES MAN POWER... HIGHLY FLEXIBLE ...DELIVERS 1-TON OR A HUNDRED WITH THE *Flip of a Finger . . .*

History books tell about the past. Business . . . successful business . . . is built by looking into, and anticipating the needs of the Future. In designing, engineering and manufacturing, KRW builds with tomorrow's needs in mind. That's our idea of Vision. The best proof of practical application can be found in the innumerable adaptations of the basic KRW Hydraulic Arbor Press which have been supplied to industry. The one illustrated on the opposite page is a typical example of KRW engineering vision. Here it has become a high-speed straightening press . . . supplanting a costlier, labor-consuming method formerly used. Other KRW contributions to low-cost production include Forming Presses... Stretcher Levellers... Forming Brakes... Improved Hydraulic Arbor Presses . . . all adaptable to either hand operation, Air-Oil operation or Electric motor operation. They are built to furnish tonnage pressures ranging from 25 to 200-tons. Their cost is surprisingly low in comparison with other suitable types of conventional equipment. The new KRW catalog gives dramatic proof of KRW engineering superiority. Mail the coupon today.

THIS NEW CATALOG WILL SAVE YOU MONEY!



K. R. WILSON
BUFFALO 3, NEW YORK

K. R. WILSON, 215-217 Main Street, Buffalo 3, N. Y.

Please mail me a copy of your
New Hydraulic Arbor Press Catalog.

Name.....

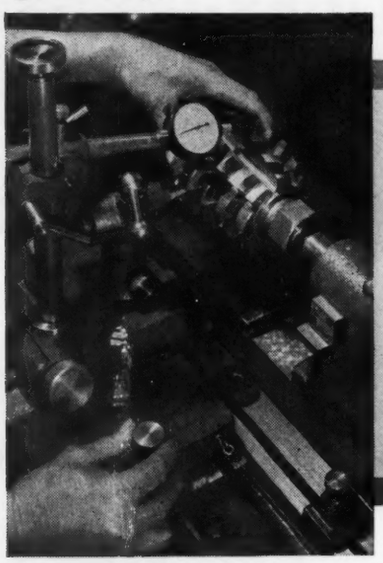
Address.....

City & Zone..... State.....

15

Sier-Bath Gears
with Minimum T.A.E. permit INCREASED SPEEDS *and* HORSEPOWER

THE smaller stresses that result from holding T.A.E. (TOTAL ACCUMULATED ERROR) to a minimum, as in Sier-Bath Gears, have made it possible for machinery manufacturers to increase horsepower loads and speeds substantially. Longer gear life, quieter operation and increased continuous service are also obtained. Let Sier-Bath submit a quotation on your gears, today.



Even the cutting tools at Sier-Bath are checked in the constant-temperature checking room. Gear checks from which every manual and visual error is eliminated are sine line lead, sine line involute, concentricity, tooth spacing, and gear action.

GEAR RANGE

Spur, helical and worm gears to 48″; worms to 12″; straight tooth bevel gears 24 pitch to 3 pitch. Gears shaved from 1″ to 24″ inclusive. Worms precision ground on J. & L. thread grinder to extremely close tolerances.

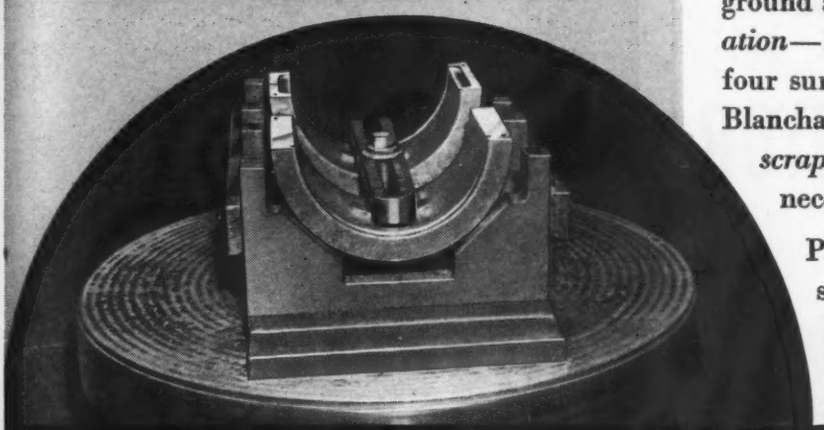
SIER-BATH GEAR COMPANY, INC.
9248 HUDSON BOULEVARD, NORTH BERGEN, N. J.

Instruments for
PRECISION

Where high precision is required Criterion Boring Heads are of value. Made by precision methods, they are obviously perfect for precision work. Lead Screw is ground from solid AFTER hardening. Large graduated dial. Criterion Heads are sold from coast to coast. Order from your dealer. Request free literature.

CRITERION MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

"Put it on the Blanchard"



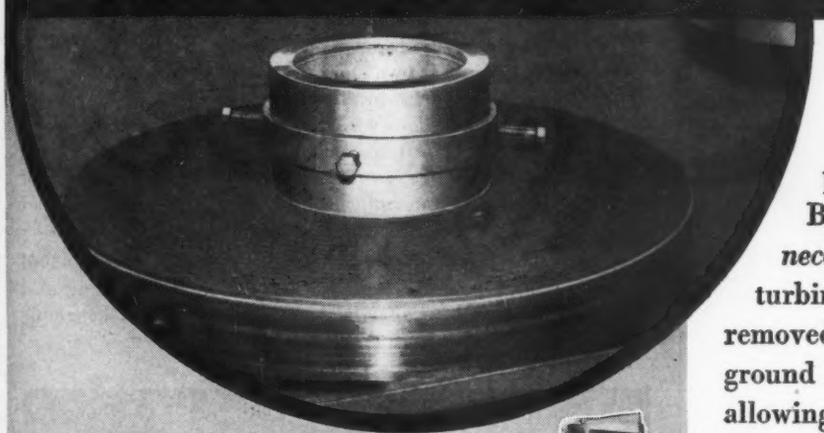
GRINDING HALVES of TURBINE BEARING

Material: steel and bearing babbit

Size (assembled): 12⅞" O.D., 9⅛" I.D., 7⅝" LG.

Held in an inexpensive fixture on the magnetic chuck of a No. 18 Blanchard Surface Grinder, *both halves* of the turbine bearing are finish-ground at the parting joint *in the same operation*—1/64" is removed from each of the four surfaces. The flatness and finish of the Blanchard-ground surfaces are such that *no scraping* or other means of correction is necessary to provide *oil-tight joints.*

Production is 4 pairs or 8 halves (16 surfaces) per hour. This includes loading and unloading the pieces in the fixture.

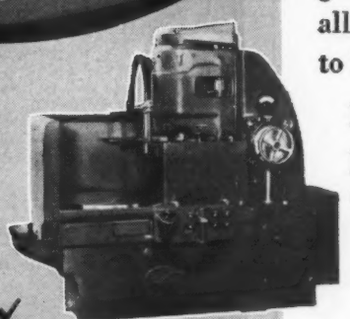


The bearing halves are then assembled and held together in a simple clamping fixture. Returned to the Blanchard—*no machine changes are necessary*—both ends of the assembled turbine bearing are finish-ground. (1/64" is removed from each end.) The Blanchard-ground end surfaces are *flat and parallel,* allowing the subsequent finish-boring operation to be registered from either of them.

Production is 8 half bearings (16 surfaces) per hour, which includes assembly and clamping time.

Get These Advantages...

PRODUCTION ✓
ADAPTABILITY ✓
FIXTURE SAVING
OPERATION SAVING ✓
MATERIAL SAVING
CLOSE LIMITS
FINE FINISH ✓
FLATNESS ✓



Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

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Straight flow

FIRE MONITOR

For *complete, fool-proof* fire protection, install CHIKSAN *Non-Spin* Fire Monitors at strategic locations. Easy turning is provided by double rows of ball bearings, permitting the Chiksan Fire Monitor to be turned full 360° in both horizontal and vertical planes. Monitor can be locked in any desired position. Since the discharge flow is in the same plane as the supply line, the Chiksan Fire Monitor will not spin. This means greater safety to the operator. Nothing to tighten or adjust. The Chiksan Fire Monitor is ready for instant action all the time. Write for latest catalog.

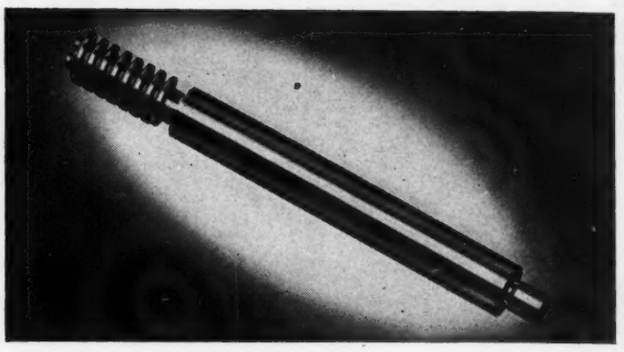
OTHER USES: Hydraulic Washing Equipment, Log Debarking, Mixing Equipment. Can be supplied with any type of nozzle required.

CHIKSAN REPRESENTATIVES IN PRINCIPAL CITIES
EXPORT REPRESENTATIVE: Chiksan Export Co., Brea, Calif.
BRANCHES: New York 7, Houston 2

CHIKSAN BALL BEARING SWIVEL JOINTS FOR ALL PURPOSES
CHIKSAN COMPANY
BREA, CALIFORNIA
New York 7 Houston 2

PRECISION PARTS

PRECISION IN THE NEWS



Flash! A dramatic news event. Pictures are needed across the country for a late edition. Rapidly and accurately, these pictures are flashed the breadth of America over a thin thread of wire by modern telephoto equipment. Here is an essential part of such equipment—a motor shaft—precision-made by Ace to take its part in the rapid transmitting of news.

First it was precision-formed on automatics from bar stock centerless ground in our own shop. At the same time, a tiny drill rod insert ¼" long and 1/16" in diameter was formed, heat-treated, and centerless ground. This was then press-fed into a 1/16" reamed hole at the end of the shaft, never to be removed. Now, the 4 main diameters were cylindrical ground on centers to a concentricity of ±.0025", with an 8-12 microinch finish. Finally, an Acme thread was ground, also concentric to the other diameters.

For precision in production quantities . . . for small parts and assemblies that require stamping, machining, heat-treating and grinding . . . you need go no farther than Ace. Send a sketch, sample or blueprint for quotation.

. . . grinding capacity open . . .

ACE TRADE MARK

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for Precision Parts
1253 E. ERIE AVE., PHILADELPHIA 24, PA.

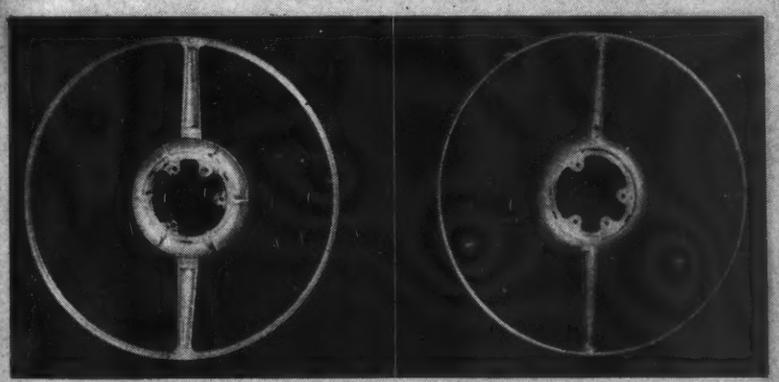
Shortcut to Production

KEARNEY & TRECKER ROTARY HEAD MILLER COMPLETES COMPLEX 3 PART DIE DIRECT FROM BLUEPRINT TO WORK-PIECE. NO TEMPLETS OR MODELS REQUIRED

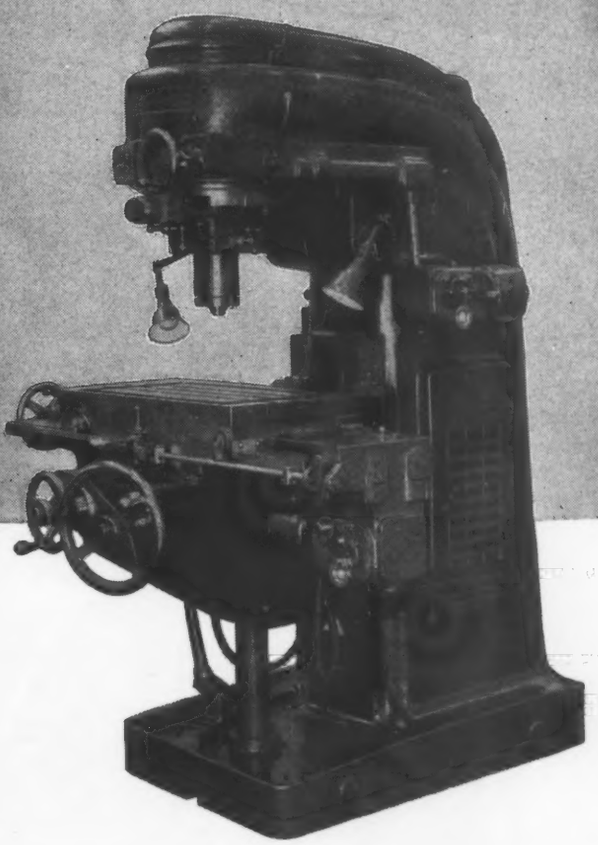
1. Shows set-up of completed ejector half of die. Note rotary table using power take-off from machine for circular milling. All operations on die face completed in single set-up. Total set-up and machining time for this piece — 69.4 hours.

2. Set-up for cover half of die. All operations on die face completed in single set-up. Total set-up and machining time for this part—74.2 hours.

3. Set-up for machining center insert part of die. Note deep narrow slots — end milled. Universal Spiral Dividing Head provides for positioning of work piece. All operations on die face completed in single set-up. Total time for set-up and machining — 86.2 hours.



Both sides of the finished horn ring for an automobile steering wheel — as it comes complete from the die being machined above.



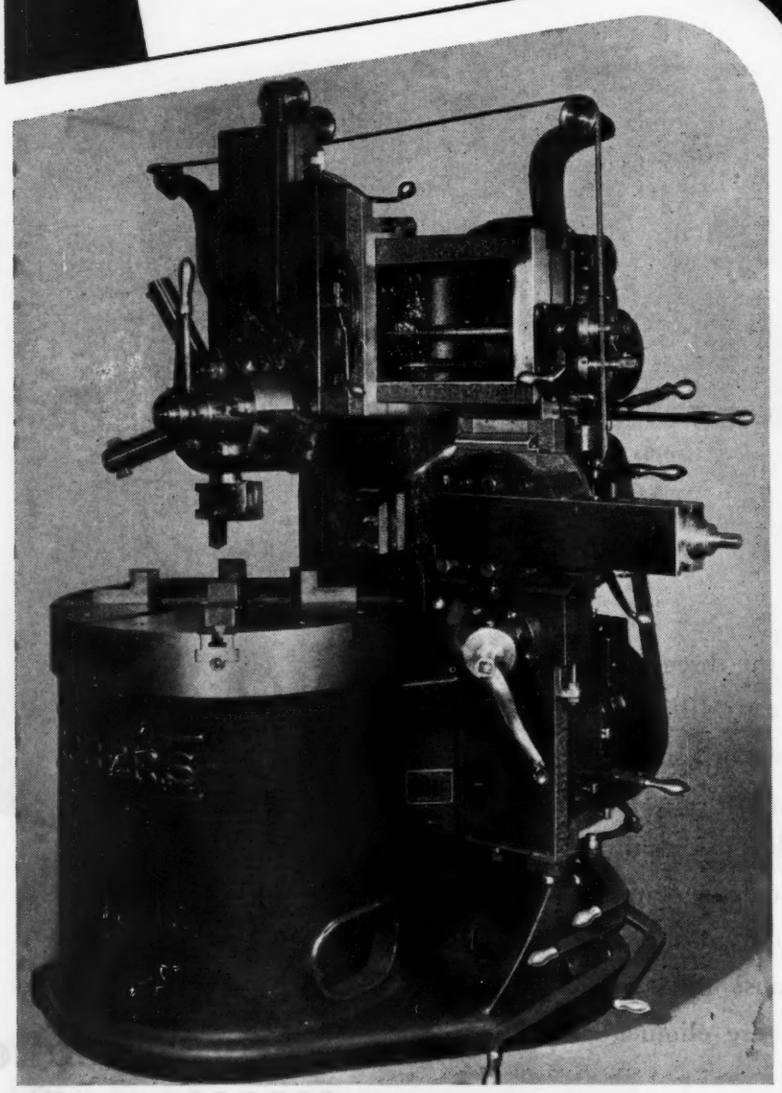
DIRECT — ACCURATE — FAST — are the three factors that make the Kearney & Trecker Rotary Head Milling Machine so outstanding for toolroom, experimental, and manufacturing work. DIRECT — because it mills intricate shapes in a single set-up, transmitting blueprint dimensions direct to the workpiece without the aid of models or templets. ACCURATE — because there is exact control of all mechanical movements. FAST — because initial preparation and multiple set-ups are eliminated.

For complete information write for Catalog 1002C.
Please give your business connection.

Kearney & Trecker
CORPORATION
MILWAUKEE 14, WISCONSIN

Announcing

A NEW TRADE-IN PLAN ON ROGERS "PERFECT 36" VERTICAL TURRET MILLS



Arrangements have been made with one of America's leading machine tool dealers to take your used machines in trade for

NEW ROGERS MILLS

Turn your out-of-date equipment into brand new Rogers Mills. We will appraise whatever old equipment you wish to trade in. This offer permits you to have all of the time-saving, money-saving efficiencies provided by NEW ROGERS MILLS.

Call or Write for Full Particulars Explaining Our Trade-In Offer

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— KNOWING HOW SINCE 1885 —

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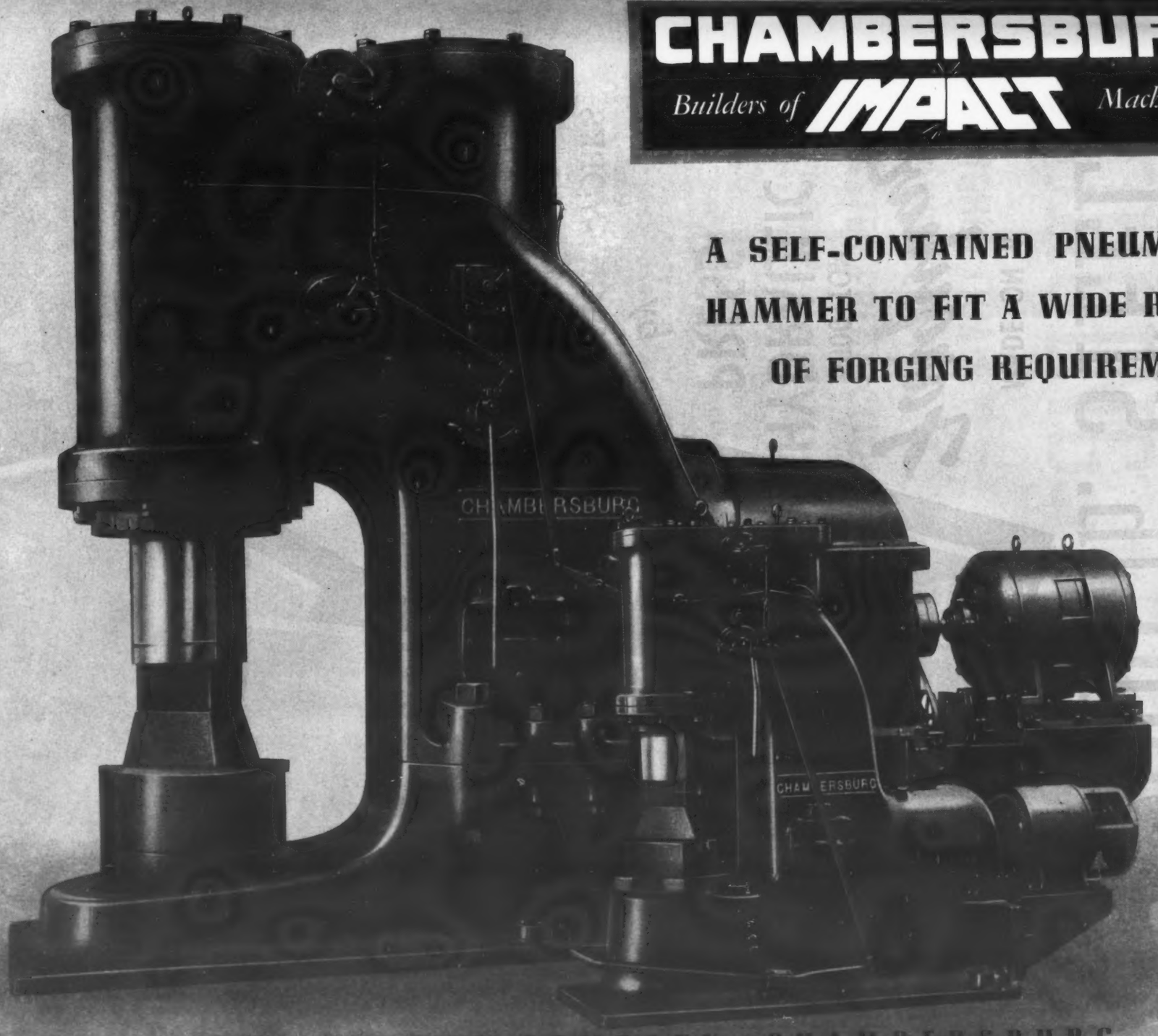
Builders of IMPACT *Machinery*

A SELF-CONTAINED PNEUMATIC HAMMER TO FIT A WIDE RANGE OF FORGING REQUIREMENTS

IN SIZES FROM 200 LBS. TO 5000 LBS.



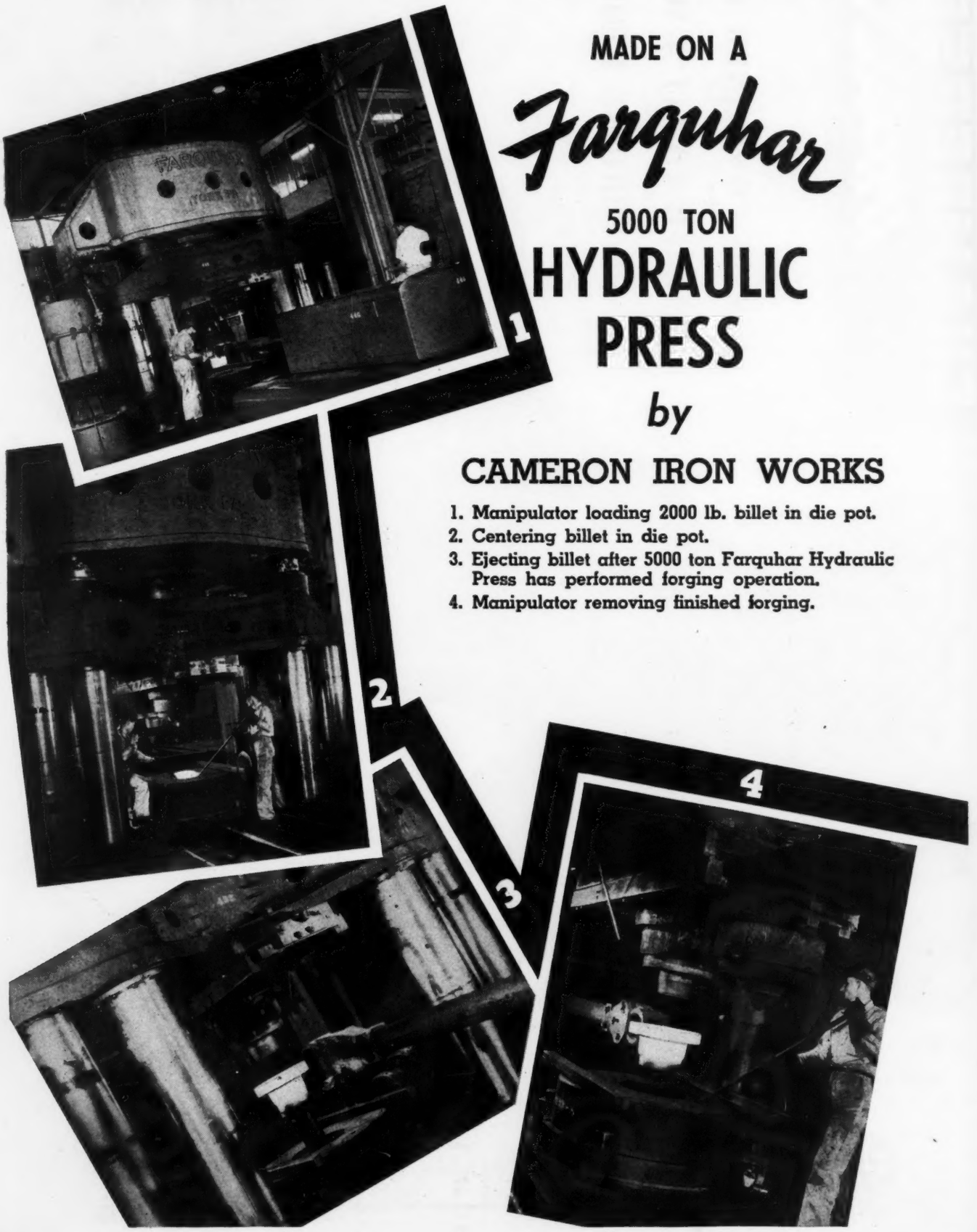
CHAMBERSBURG ENGINEERING COMPANY, CHAMBERSBURG, PA.

2000 lb. STEEL

MADE ON A *Farquhar* 5000 TON HYDRAULIC PRESS

by

CAMERON IRON WORKS



1. Manipulator loading 2000 lb. billet in die pot.
2. Centering billet in die pot.
3. Ejecting billet after 5000 ton Farquhar Hydraulic Press has performed forging operation.
4. Manipulator removing finished forging.

FORGING

★ HIGHER QUALITY

★ LOWER COST

★ FASTER PRODUCTION

The Cameron Iron Works, Houston, Texas, known throughout the world for petroleum industry equipment, recently installed in its new forge shop a 5000 ton Farquhar Hydraulic Press especially designed to produce a higher quality product faster at lower cost. Today, Farquhar's 5000 ton Hydraulic Press in Cameron's shop turns out forgings that are vastly improved because they are:

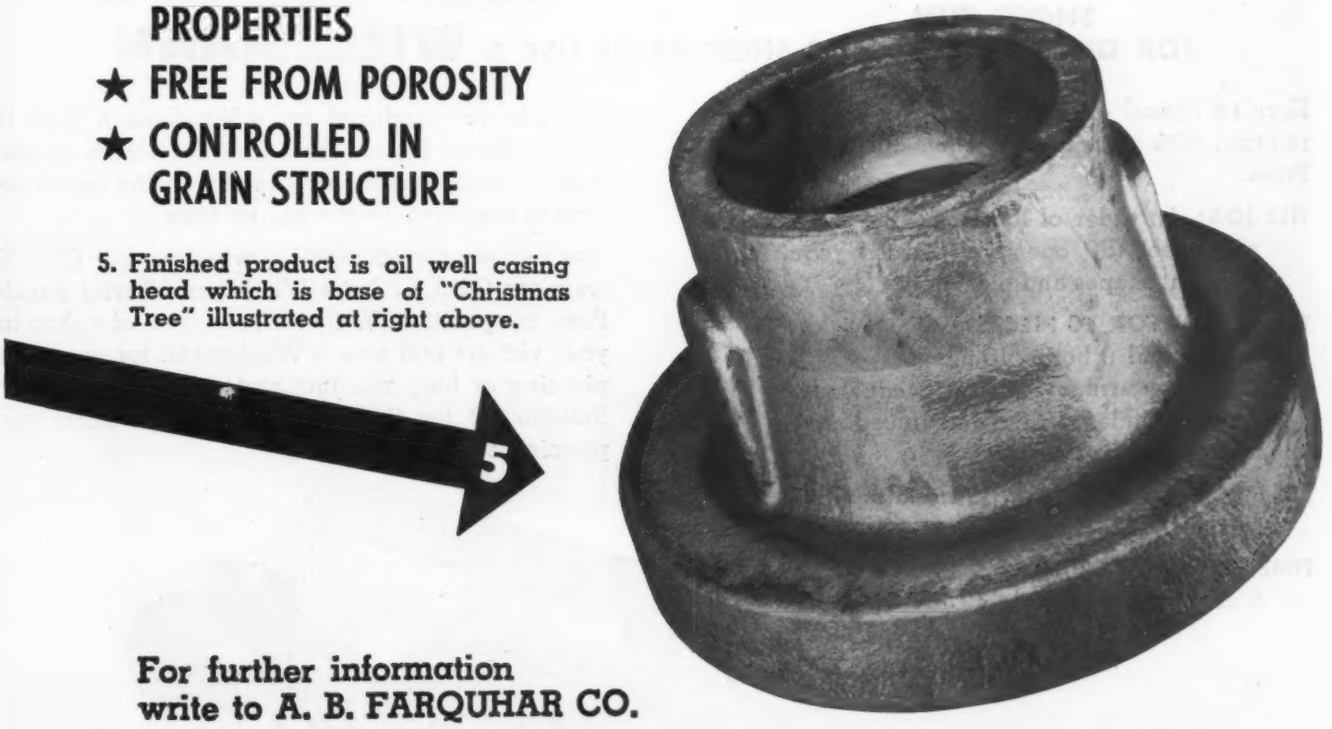
The petroleum industry knows this Cameron-produced equipment as the "Christmas Tree." It is used for directing and controlling the flow of oil from wells.

★ UNIFORM IN PHYSICAL PROPERTIES

★ FREE FROM POROSITY

★ CONTROLLED IN GRAIN STRUCTURE

5. Finished product is oil well casing head which is base of "Christmas Tree" illustrated at right above.



For further information write to A. B. FARQUHAR CO.

1856 NINETIETH ANNIVERSARY YEAR **A. B. FARQUHAR COMPANY** 1946

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Branch Office: 626 W. Elm Street, Chicago, Ill.

WHEN WE SAY QUICK WE MEAN QUICK!

SHORT RUN FOR QUICK PIERCING OF SHEET METAL USE A WIEDEMANN

Here's a typical example of how piercing time was reduced 90% by using a Wiedemann Turret Punch Press.

THE JOB: An order of 10 pieces 12⅝ x 8½ x .078 mild steel (50 openings pierced requiring 7 different shapes and diameters)

TOTAL TIME FOR 10 PIECES:

OLD METHOD: 9 hours, 16 minutes

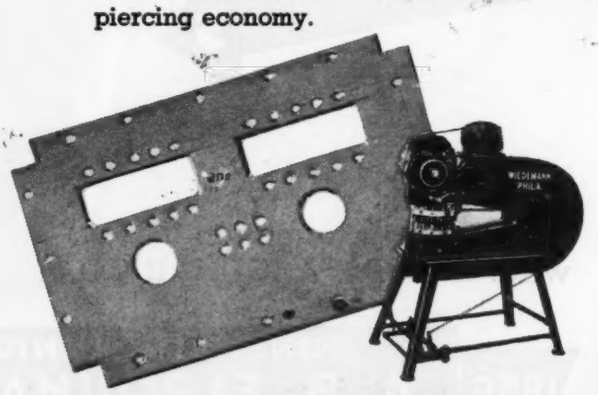
WIEDEMANN METHOD: 1 hour, 16 minutes (Time includes loading and unloading material in the machine)

TIME FOR 1st PIECE . . . 19 minutes, 18 seconds

TIME FOR EACH OF NEXT 9 PIECES . . 6 minutes, 39 seconds

The job was produced on a Wiedemann R-4P 11 Station Turret Punch Press with Drop-latch gauge. *Layout work was done directly in the machine and is included in the above time.*

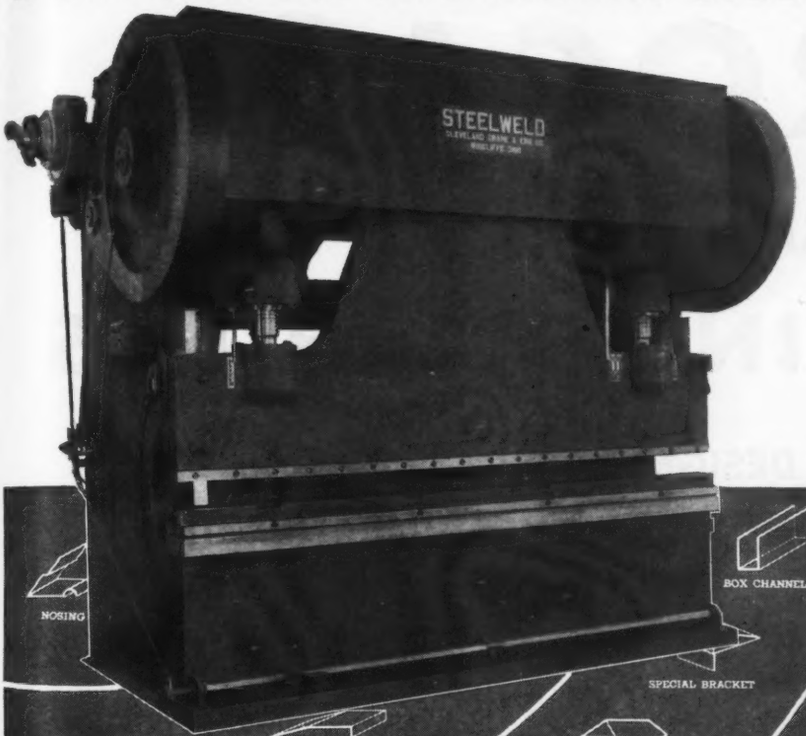
You can see for yourself . . . when we say QUICK we mean QUICK. See a Wiedemann Turret Punch Press in operation. Write us for address of a shop in your vicinity that uses a Wiedemann for short run piercing at long run low cost . . . and send for Bulletin 92 for the complete story of short run piercing economy.

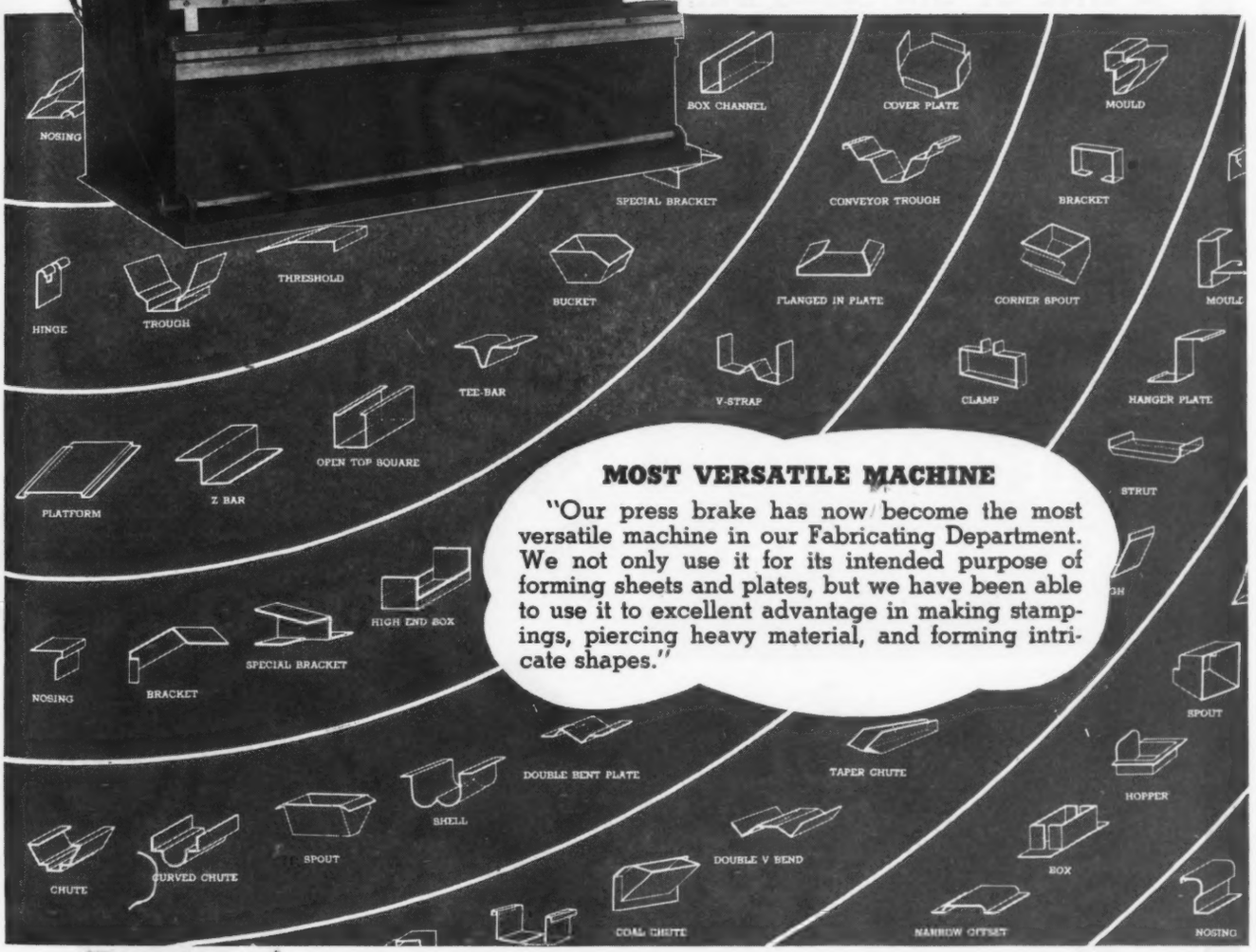


WIEDEMANN MACHINE COMPANY
1807 SEDGLEY AVENUE, PHILADELPHIA 32, PA.

WIEDEMANN TURRET PUNCH PRESSES & GAUGE TABLES

WORDS FROM PROMINENT STEELWELD PRESS USERS





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"Our press brake has now become the most versatile machine in our Fabricating Department. We not only use it for its intended purpose of forming sheets and plates, but we have been able to use it to excellent advantage in making stampings, piercing heavy material, and forming intricate shapes."

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CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

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BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

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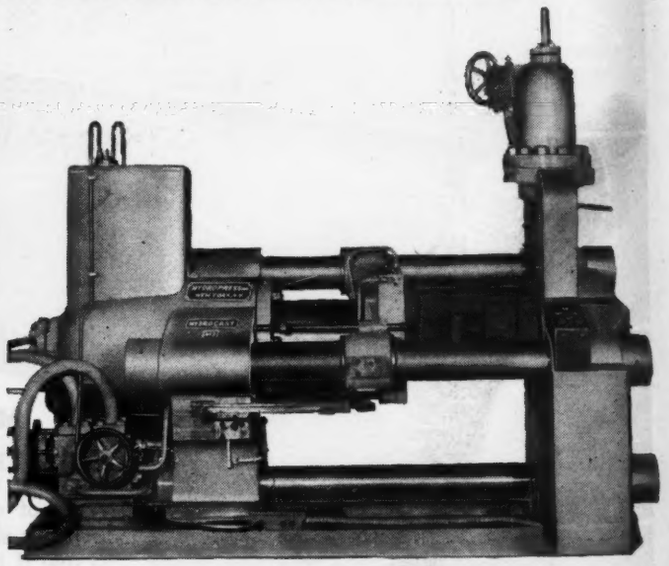

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DIE CASTING PROBLEM
WE WILL WORK IT OUT IN ACCORDANCE WITH YOUR SPECIAL REQUIREMENTS
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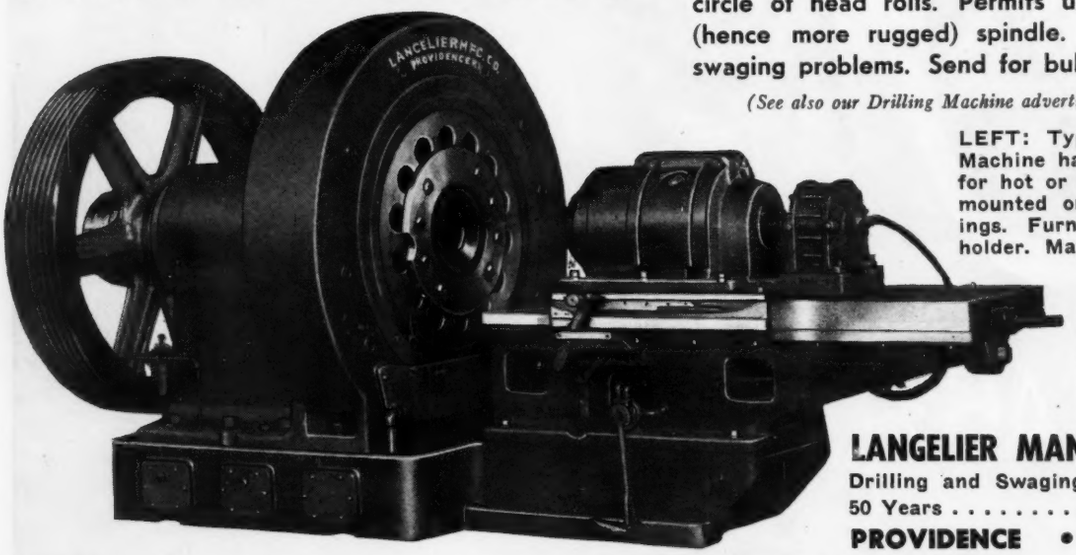
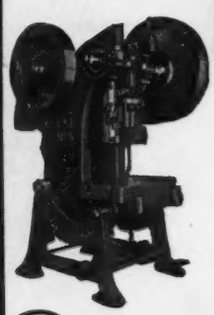
Whether your swaging needs involve pin-pointing or pointing 7" dia. tubes—there is a modern, improved Langelier Swaging Machine that will do the work speedily, accurately, efficiently—and deliver important economies in machining costs. More than 50 years of swaging "know-how" are built into every Langelier Swager. Here's just one important advancement: Timken-mounted spindle reduces power consumption, decreases friction, lengthens life of parts as compared with old-style plain bearing mountings; also assures close concentricity between revolving spindle and circle of head rolls. Permits use of much shorter (hence more rugged) spindle. Let us solve your swaging problems. Send for bulletins.

(See also our Drilling Machine advertisement in this issue.)



LEFT: Type J, K and L Swaging Machine has water-jacketed head for hot or cold swaging. Spindle mounted on Timken roller bearings. Furnished with or without holder. Machine as shown here is equipped with hydraulic feeding mechanism and pneumatically operated rotating chuck: Capacity, tubing: Type J, 4". Type K, 4½". Type L, 6½".

LANGELIER MANUFACTURING CO.
Drilling and Swaging Specialists for Over 50 Years . . . . . Incorporated 1887
PROVIDENCE • RHODE ISLAND



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POWER PUNCH PRESSES
5 TO 79 TONS

No. 5 BACK GEARED
49 Ton Capacity
45 Strokes per minute
*10¼ Die Space
(Bed to slide, stroke down, adj. up)
4" Standard Stroke
6700 lbs. weight
Also available in plain flywheel type
*No. 5 Special has 15¼" Die Space
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SUCCESSORS TO LOSHBOUGH JORDAN TOOL & MACHINE CO.

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Are Built Standard with Capacities Up to 6" Dia. Larger Sizes Up to 14" Dia. Are Built On Order.

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Hydraulic Operated Tube Cutoff Mach.

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THE DIE SET AUTHORITY

All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver.
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SURFACE PLATES AND SPECIAL MACHINERY
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Most modern Nibbler for Template Cutting, Tool Rooms, Shipbuilding, Aircraft Parts, Aircraft Tubing, Sheet and Plate Shops.

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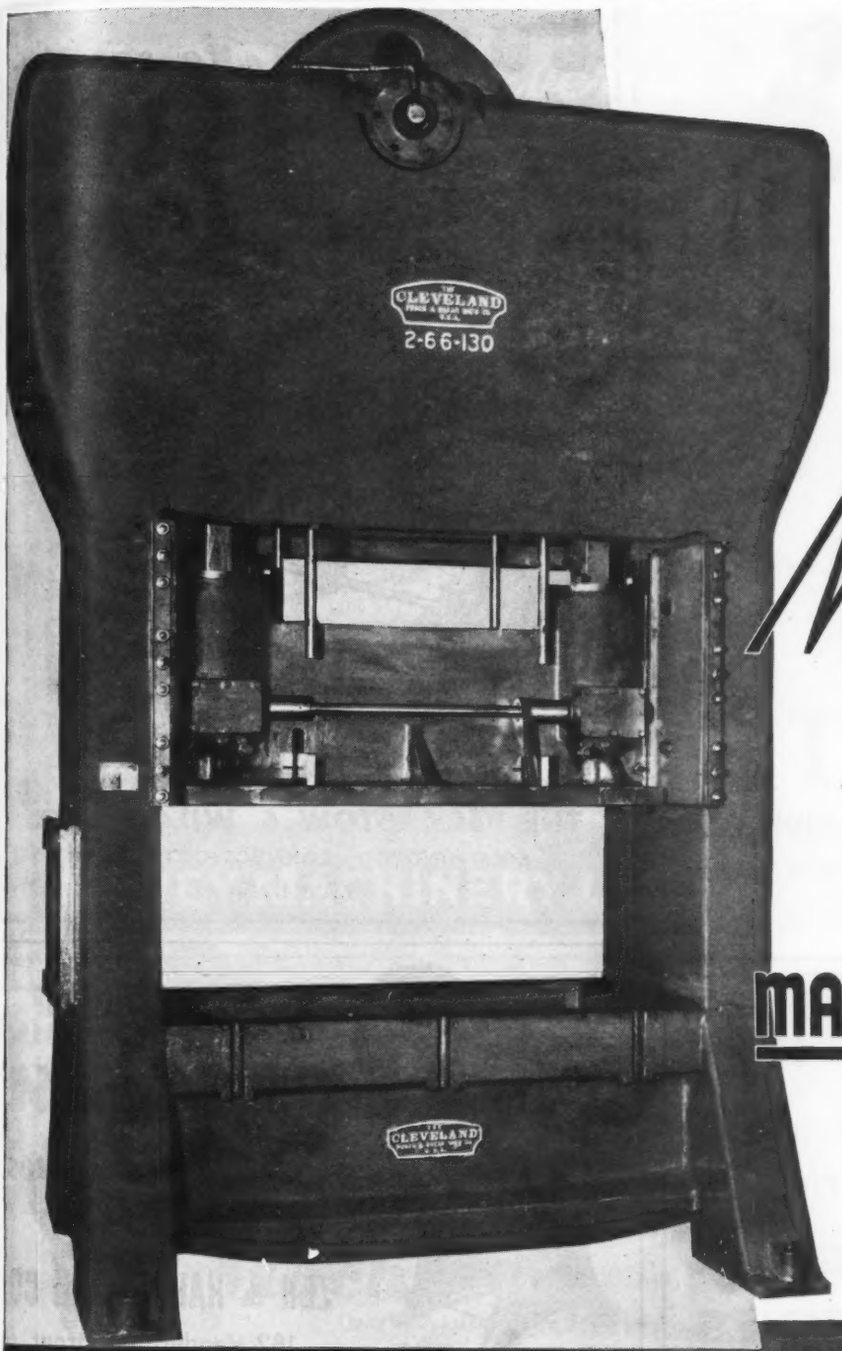

Modern Presses For MASS PRODUCTION

Many leading manufacturers of consumer goods, such as: electrical appliances, refrigerators, kitchen utensils, washing machines, automobiles, office equipment, etc., who are confronted with an unprecedented demand for their products, are finding it profitable to install Modern Cleveland Presses, because their design and construction makes them particularly suitable for the mass production of complete metal products or extremely accurate component parts.

If you are interested in stepping up your production through the use of reliable and accurate Modern Presses, equipped with either air or hydraulically operated friction clutch and brake, controlled through conveniently located push buttons, we suggest that you write for a copy of our Modern Press catalog which illustrates and describes the Single Point, Two Point and Four Point Presses.

THE CLEVELAND PUNCH & SHEAR WORKS CO.

CLEVELAND 14, OHIO

Above illustration shows a Modern Cleveland Two Point Press which is arranged with an electrically controlled, air operated friction clutch and brake.

The slide of the Press is air counterbalanced and the flywheel is provided with a separate air brake to bring it to a quick stop.

The Press illustrated has a 36″ x 66″ bed area, 10″ stroke, 4″ adjustment, operates at 38 R.P.M. and has a capacity of 130 tons.

This machine is typical of the Cleveland line of Modern Presses which can be furnished in Single Point, Two Point and Four Point types, and in sizes and capacities to suit particular requirements.

Send samples or prints

...of your work, and get our suggestions for tight or loose riveting, performed better, faster and more surely on Grant machines.

Grant Rotary Vibratory Riveter

Grant Noiseless Rivet Spinner

GRANT MFG. & MACHINE CO.

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BUILT... *to satisfy skilled* CRAFTSMEN

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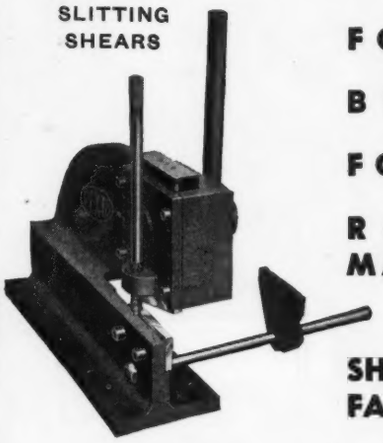

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for all
SHEET METAL FABRICATION

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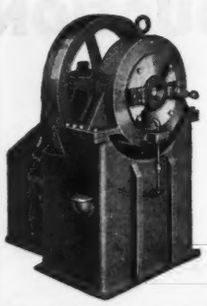

Swaging—*What* it is and *How* it is done on

TORRINGTON SWAGING MACHINES

All explained in booklet—"The Torrington Swaging Machine"—Your copy mailed on request.

Examples of many possible operations by the Rotary Swaging Method:—

1 Point rods for drawing
2 Pointed rods and tubing
3 Tapered rods and tubing
4 Acetylene torch tips
5 Curling iron tubes
6 Bonding Ferrules to cables
7 Steel furniture legs
8 Tap blanks
9 Banding Rotating Bands on shells
10 Meat hooks
11 Refrigerator expansion bulbs
12 Sizing and Reducing wire

Present Owners of Torrington Swaging Machines are quoted promptly on request for prices for die renewals, etc.

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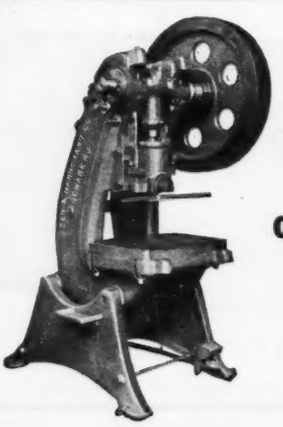
55 Field Street Torrington, Conn.



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MULTIPLE SPINDLE LATHES
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MOREY *Universal* TURRET LATHES *for* BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM,
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
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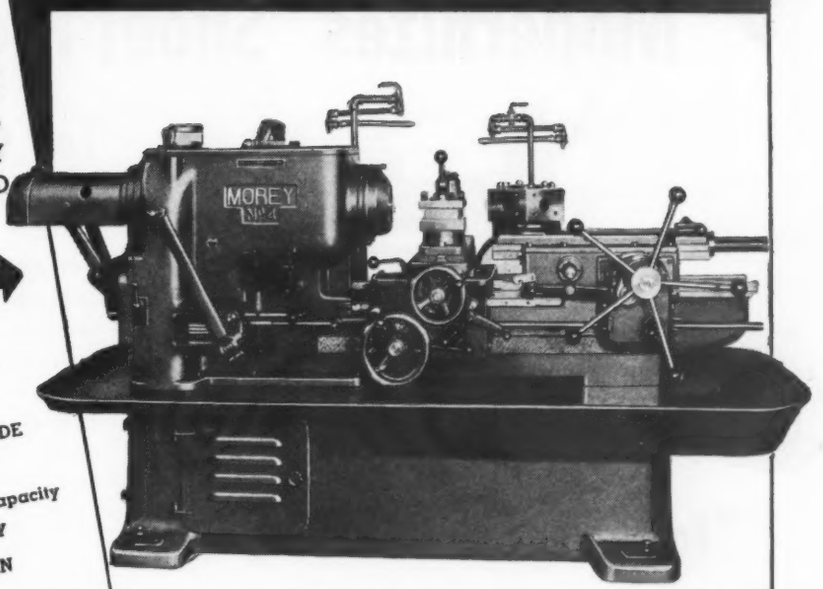

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FRANK E. EBERHARDT, President

S&S

STOCK REELS
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ROLL FEEDS
For any size and type of press. Reels for feeding coil stock. Dial feeds for 8, 12 or 16 stations—1 to 3 operations. Single and double type roll feeds. Write for prices and specifications.

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PRODUCTO PRODUCTO

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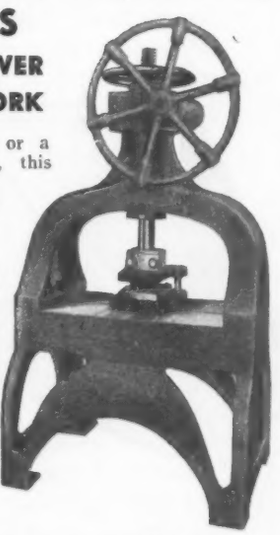
UTILITY PRESS
VERSATILITY... POWER for TOOL and DIE WORK



Whether the lightest touch or a 50-ton pressure is required, this modern screw press is indispensable for the countless press jobs that confront busy tool and die rooms.

You will find it efficient for shearing, assembling and lining Punches and Dies, and for separating Punch and Die Holders on large Liner Pin Die Sets. The 3" hole in the bed allows it to be used for short broaching operations and for disassembling spindles or shafts from press fits in bearings.

Also has many Arbor and Straightening press uses.

Send for detailed circular.

CALL

THE **PRODUCTO** MACHINE COMPANY
BRIDGEPORT 1, 998 HOUSATONIC AVE.

NEW YORK, 12
197 LAFAYETTE ST.

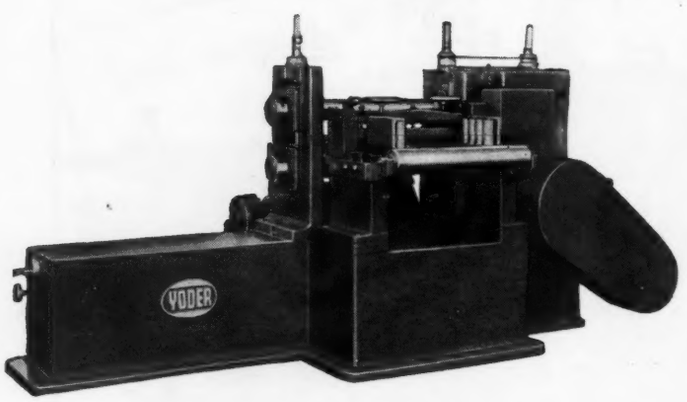
CLEVELAND, 14
5345 ST. CLAIR AVE.

INDIANAPOLIS, 2
635 FULTON ST.

DETROIT, 11
3017 MEDBURY

LOS ANGELES, 21
2180 E. OLYMPIC BOULEVARD

Yoder Coil-Strip Machinery* Modernizes "Sheet Metal" Processing

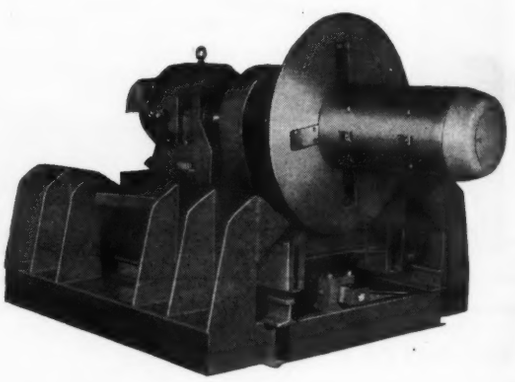


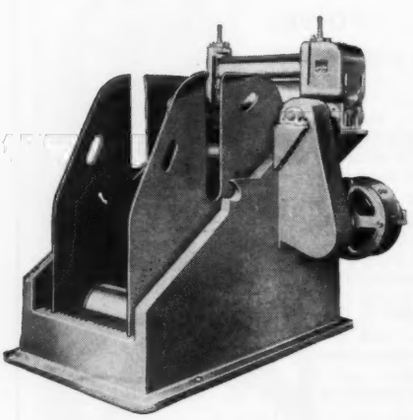
*For Gang-Slitting Mill Widths

YODER metal slitting equipment converts mill widths 12" to 120" into thousands of production sizes, handling shim stock or heavy gauges with equal efficiency. Easy loading, precision slitting throughout the run, convenient recoiling and unloading of slit stock, high speed, one-man control and other features make this the most widely used and best liked equipment in the industry. Coil, sheet or combination slitters, edge trimmers or complete slitting lines available to fit every slitting or trimming requirement.

*For Coiling or Uncoiling Strip

YODER uncoilers and recoilers virtually set a standard in the metal handling industries, for the very practical reason of the ease and efficiency with which they handle any type of metal from the extreme light to heaviest coils milled. Sturdy roller bearings assure smooth feed and minimum power requirement in all sizes. Expanding drum types available with power or manual expansion. Pull-out types have adjustable drag brake to control unwind. Wide variety of powered types include a patented high speed double drum recoiler. Swivel mounting of drums permits unloading of finished coils while machine is winding next load. Yoder uncoilers and recoilers are designed for single or gang coiling.





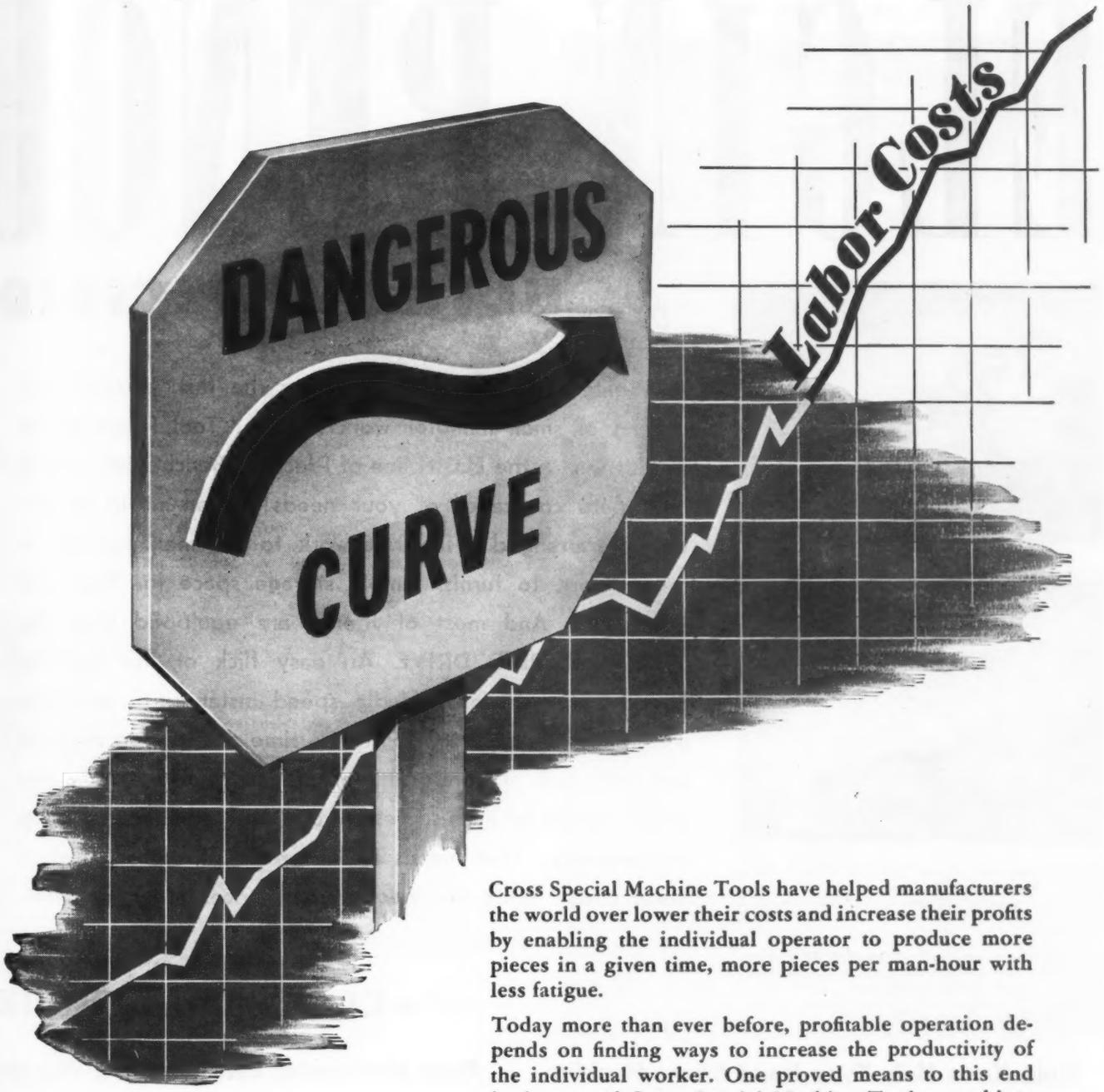
*For Coil-Feeding Processing Machines

YODER coil boxes, too, are widely popular wherever coils are handled. Large sizes may be had with power driven pull-out pinch-rolls. The Yoder "idle roll" coil box affords the simplest and in many cases the best mounting of coils for automatic feeding in such production as blanking, stamping roll forming or other continuous processing. The coil rides on tubular steel rollers, mounted in sealed, grease packed ball bearings. (See view at right). Nine sizes with adjustable sides provide strip capacities from one inch to 38", 2,300 lbs. to four ton capacity. All feed smoothly to the end, are easy to reload with minimum down time.

Ask for Bulletin G-451 describing all Yoder special machinery.

THE YODER COMPANY

5504 Walworth Avenue • Cleveland 2, Ohio



Cross Special Machine Tools have helped manufacturers the world over lower their costs and increase their profits by enabling the individual operator to produce more pieces in a given time, more pieces per man-hour with less fatigue.

Today more than ever before, profitable operation depends on finding ways to increase the productivity of the individual worker. One proved means to this end is the use of Cross Special Machine Tools—machines designed to perform any or all of a series of processing operations, automatically, at the push of a button—machines specially designed and built around the requirements of a particular need.

Lowell Thomas tells the story of this production technique in a new Cross motion picture, "Tools For Profit." Prints are available now for group showings. The film runs approximately a half hour, and your request for booking, on your letterhead, will have our prompt attention.

THE CROSS COMPANY

Established 1898

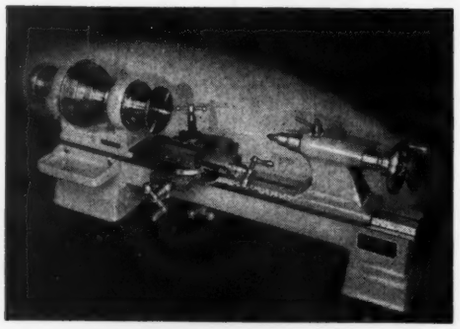
SPECIAL MACHINE TOOLS

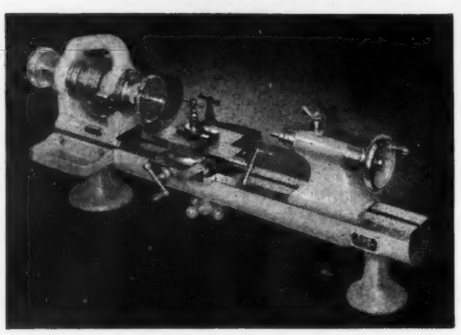
MILLING · DRILLING · TAPPING · BORING · TURNING · SHAPING · GRINDING · HONING

DETROIT 7, MICHIGAN

ELGIN BENCH

for ULTRA PRECISION





(Above, top illustration) **Model CB-5C Precision Bench Lathe.** Open Cone Headstock. 1" collet capacity, 9" swing, 17" between centers, 36" bed. Speeds up to 4000 RPM. Flat belt only.

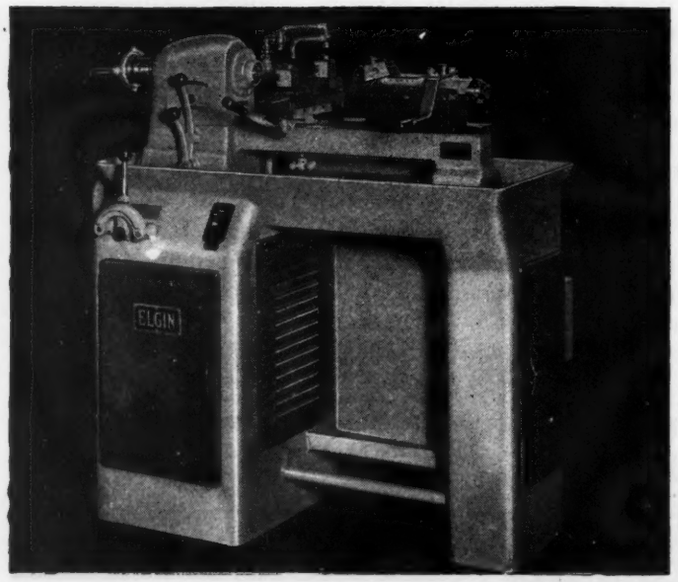
(Above, lower illustration) **Model 4EV Precision Bench Lathe.** Open Cone V-belt Headstock. For either V or flat belt. 7/16" collet capacity, 7" swing, 17" between centers, 32" bed. Speeds to 10,000 RPM.

• Whatever your requirements for the fast, accurate machining of small-diameter work . . . for Tool Room or for Production . . . the ELGIN line of Precision Bench Tools assures "complete coverage" of your needs! Clean-cut in design, they are arranged to facilitate work, to give maximum operator comfort, to furnish ample storage space for tools and accessories. And most of them* are equipped with the VARIABLE SPEED DRIVE. An easy flick of the Variable Speed Lever changes spindle speed instantly to any rate within a wide range of RPM – no time out to stop machine and shift belt. Operator is encouraged to use exactly the proper speed for each successive operation, changing as often as necessary. That means closer precision, better finishes, lower costs. Write for specifications, prices, delivery dates.

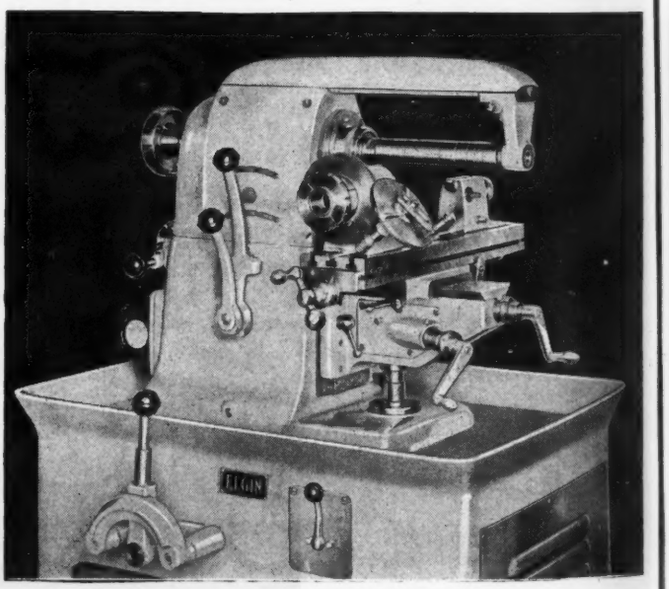
*Except Vertical Miller and the two Lathes shown in small illustrations at upper left.

• ELGIN TOOL WORKS

Elgin Knee Hole Type Hand Screw Machine



Elgin Horizontal Bench Milling Machine



TOOLS

ON SMALL WORK

ILLUSTRATIONS *(reading clockwise)*

Elgin Desk Type Bench Lathe—Variable Speed Drive, 40 to 4000 RPM. Low speed rate for grinding operations. Free turning spindle for truing-up and setting work by hand. Ample drawer space. 9" swing, 17" between centers, 1" collet.

Elgin Knee Hole Type Bench Lathe—Has Variable Speed Drive with range from 120 to 3800 RPM. 9" swing, 17" between centers, 1" collet. Generous leg room for operator. Door of motor cabinet fitted with collet rack. Three roomy storage shelves.

Elgin Open Bench Lathe—Laminated hard maple top, enclosed motor, safety guard for belt, handy collet drawer. Variable Speed Drive for any spindle speed from 120 to 3800 RPM. 9" swing, 17" between centers, 1" collet.

Elgin Vertical Bench Milling Machine — Preloaded ball bearing spindle. 9/16" collet capacity. Five speeds ranging from 400 to 4000 RPM. Vertical travel of spindle, 1¾". Table 4⅛" x 18". 90° swivel each side of center line.

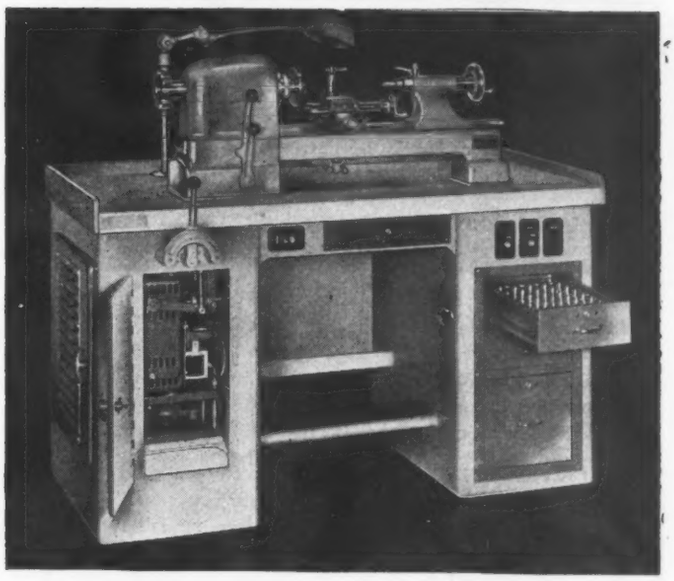
Elgin Horizontal Bench Milling Machine—Equipped with Variable Speed Drive for spindle speeds from 85 to 2750 RPM. Collet capacity, 1". Table 4⅛" x 18". Longitudinal travel, 12". Transverse travel, 6". Vertical travel, 6".

Elgin Knee Hole Type Hand Screw Machine — Variable Speed range, 120 to 3800 RPM. 9" swing, 1" collet capacity. Collet rack inside of motor compartment door. Independent coolant system (5 gal.) mounted in rear, outside—cleaner, more accessible.

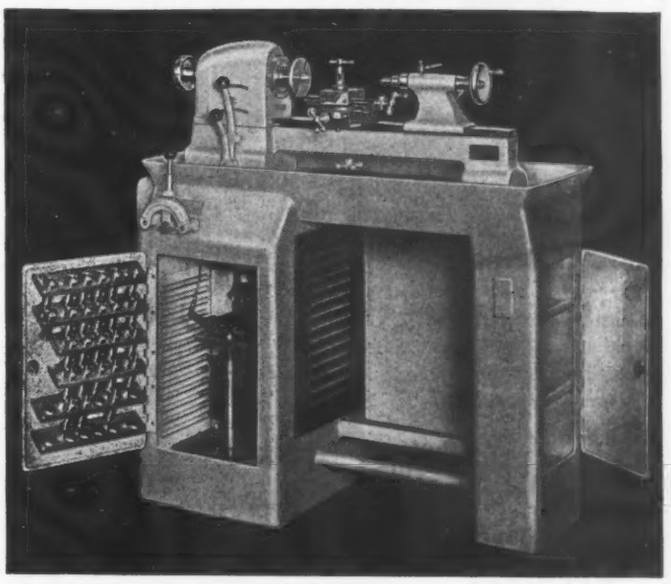
1770 Berteau Avenue, Chicago 13, Illinois

Elgin Vertical Bench Milling Machine

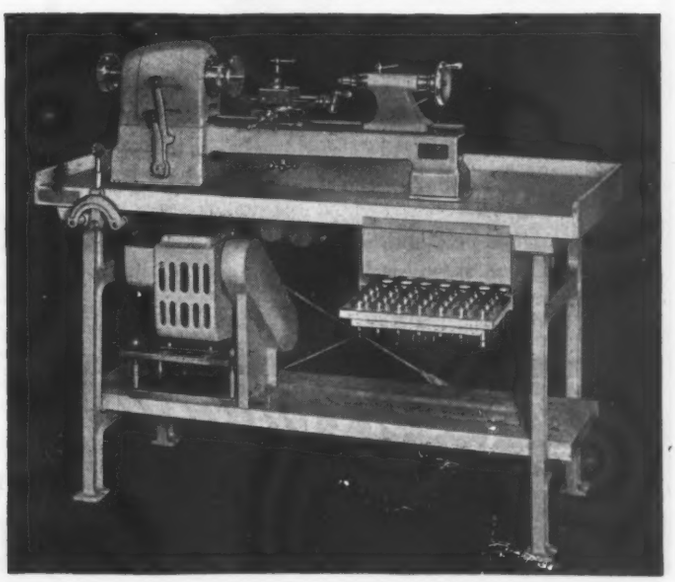
Below: **Elgin Desk Type Bench Lathe**



Below: **Elgin Knee Hole Type Bench Lathe**

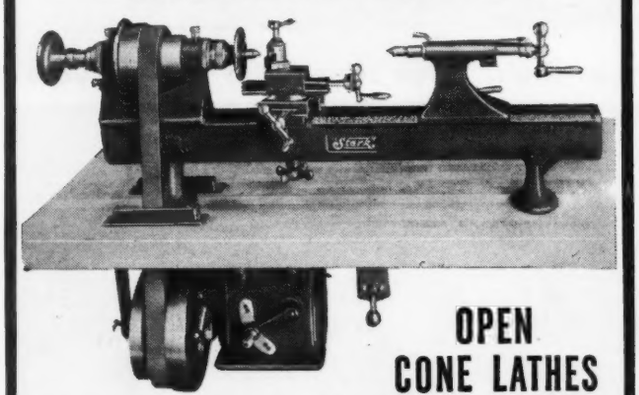


Below: **Elgin Open Bench Lathe**



Built-in infinitely adjustable drive with any speed at the turn of a convenient handwheel in front. No special bench or cabinet required. 156 to 2200 r.p.m. with Standard (toolroom) model and 220 to 3500 with High Speed (Manufacturing) model. Smooth brake and clutch. Capacity, 3/4" or 1" through headstock; 9" swing, 40" length bed.

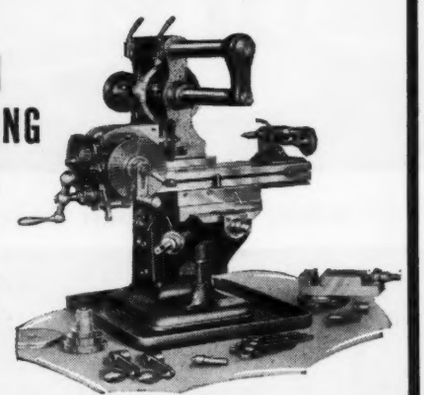
30 PRECISION ATTACHMENTS correctly designed for the very best facility and accuracy are interchangeable with all Starks of the same lathe size



OPEN CONE LATHES

Built in four good sizes, 1/4" x 5 7/8" swing, 1/2" x 7", 3/4" x 9" and 1" x 9" with Stark Motor Drive Unit, the first compact, smooth under-bench drive, with 9 speeds — the full working range.

PRECISION BENCH MILLING MACHINES



Plain and Spiral Models, motor-driven. Table 18" x 4", feed 10", transverse 3 1/2", vertical over vise 4 3/4".

FOR EXACTING PRODUCTION it is fitted with fast lever feeds

Also "ELECTROBLAST" Muffle Furnaces

Gas fired. High speed steel temperatures in 20 minutes. Built in two small sizes.

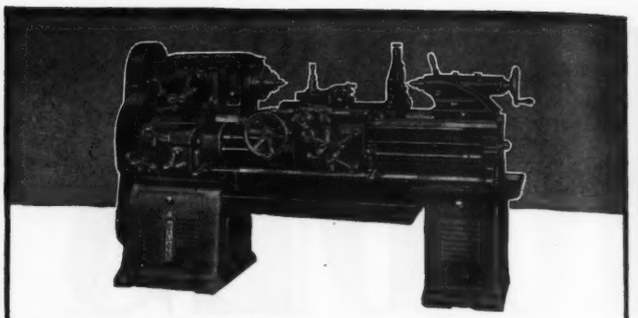
FOR FURTHER INFORMATION, WRITE US.

Stark Tool Company

WALTHAM · MASSACHUSETTS

ESTABLISHED · 1862

Originators of the American Bench Lathe



BRADFORD *Metalmaster* LATHES

have this standard equipment

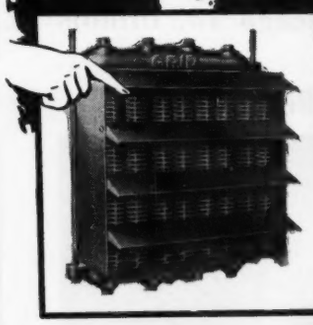
- 12-Speed Timken Geared Headstock
- Quick Change Gear Device
- Double Wall Apron
- Tailstock
- Compound Rest
- Tool Post with Ring, Wedge, Square
- Steady Rest
- Face Plate
- Dog Plate
- Head Center Bushing
- Chasing Dial
- 2-Centers
- Wrenches
- Motor Mounting and Wiring
- Push Button and Starter
- Vee Belt Drive
- Automatic Lubrication in Head
- Cabinet Legs on Head and Tailstock End of Bed
- Lever Control for Length and Cross Feeds
- Mechanical Apron Clutch Control
- Threaded Spindle Nose

The BRADFORD MACHINE TOOL CO.

1840—1946 CINCINNATI, OHIO

INSTALL GRID UNIT HEATERS

THEY WILL LAST AS LONG AS THE PIPES FURNISHING STEAM TO THEM!



here's why!

★ One piece construction heating sections (patented) of high test cast iron that will withstand steam pressures up to 250 lbs.

★ No soldered, brazed, welded or expanded connections to become loose or develop leaks.

★ No electrolysis to cause corrosion, breakdowns, leaks or heating failures.

It's the material that makes a difference in GRID Unit Heaters. That's why they are free from maintenance expense. Many units in operation 15 years without any maintenance. Capacity tables on request.

Send for booklet "Corrosion in Unit Heaters"—free upon request.

HIGH TEST CAST IRON HEATING SECTIONS

GRID

D. J. MURRAY MANUFACTURING CO. WAUSAU WISCONSIN

NEW CATALOG

Here is a catalog bright and new
Compiled by us to present to you

It's a key to higher profit
And it's free—just write us for it.

Wade

The Wade Tool Co.
52 RIVER ST.
WALTHAM 54, MASS.

Please send me the new Wade Hand Screw Machine Catalog No. **52**.

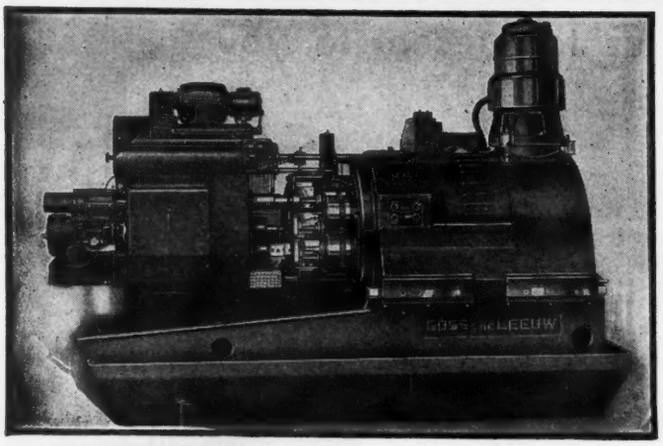
NAME _____ TITLE _____

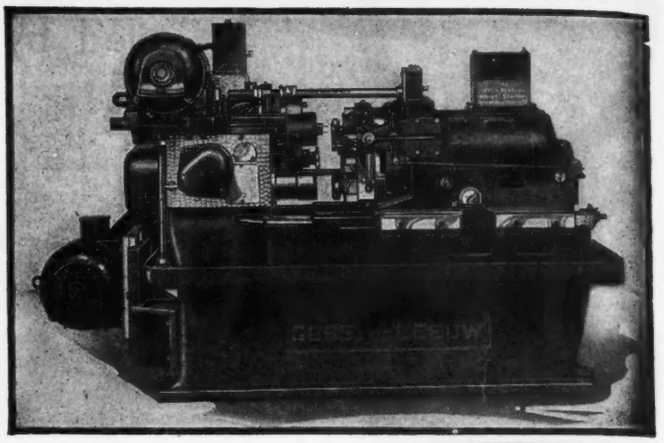
COMPANY _____

STREET _____

CITY _____ STATE _____

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES





WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

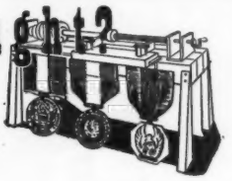
Features include:
Lead Screw Threading on both types—Pre-loaded Anti-friction Spindle Bearings—Hardened Ways—Oversized Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

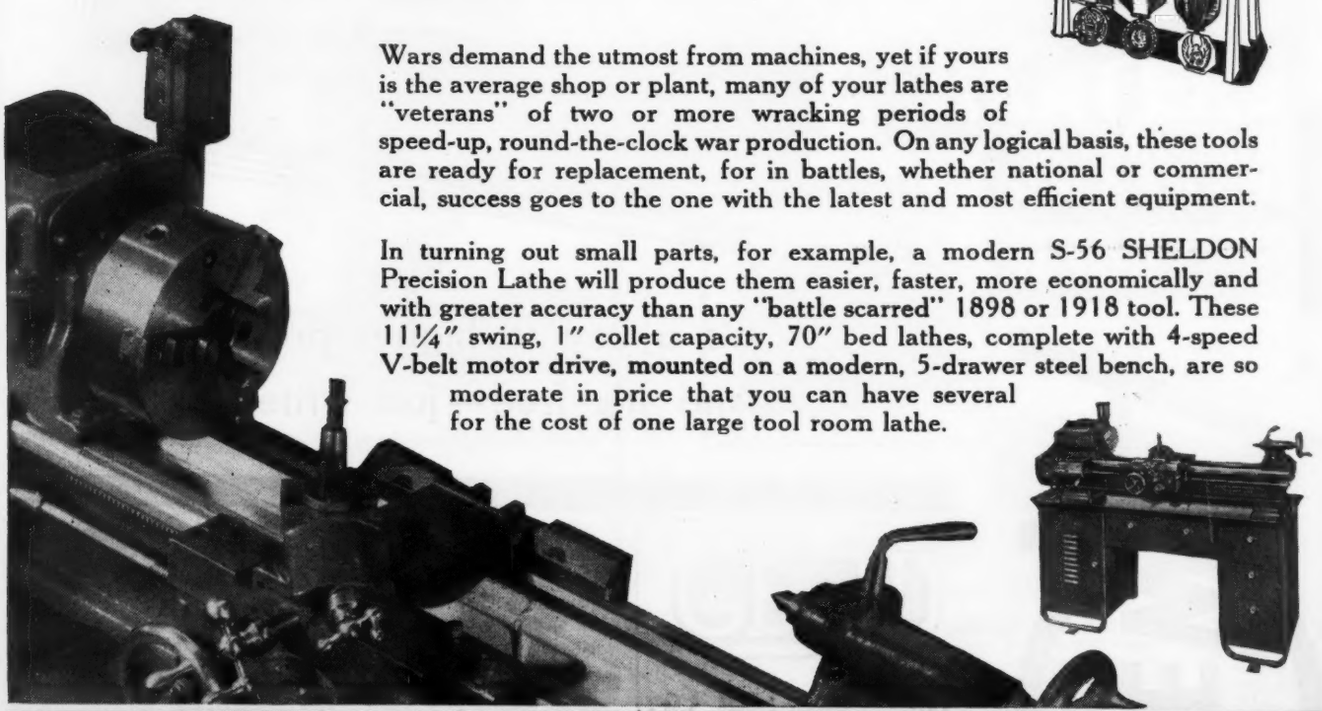
Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

How many Wars have your lathes fought?





Wars demand the utmost from machines, yet if yours is the average shop or plant, many of your lathes are "veterans" of two or more wracking periods of speed-up, round-the-clock war production. On any logical basis, these tools are ready for replacement, for in battles, whether national or commercial, success goes to the one with the latest and most efficient equipment.

In turning out small parts, for example, a modern S-56 SHELDON Precision Lathe will produce them easier, faster, more economically and with greater accuracy than any "battle scarred" 1898 or 1918 tool. These 11¼" swing, 1" collet capacity, 70" bed lathes, complete with 4-speed V-belt motor drive, mounted on a modern, 5-drawer steel bench, are so moderate in price that you can have several for the cost of one large tool room lathe.

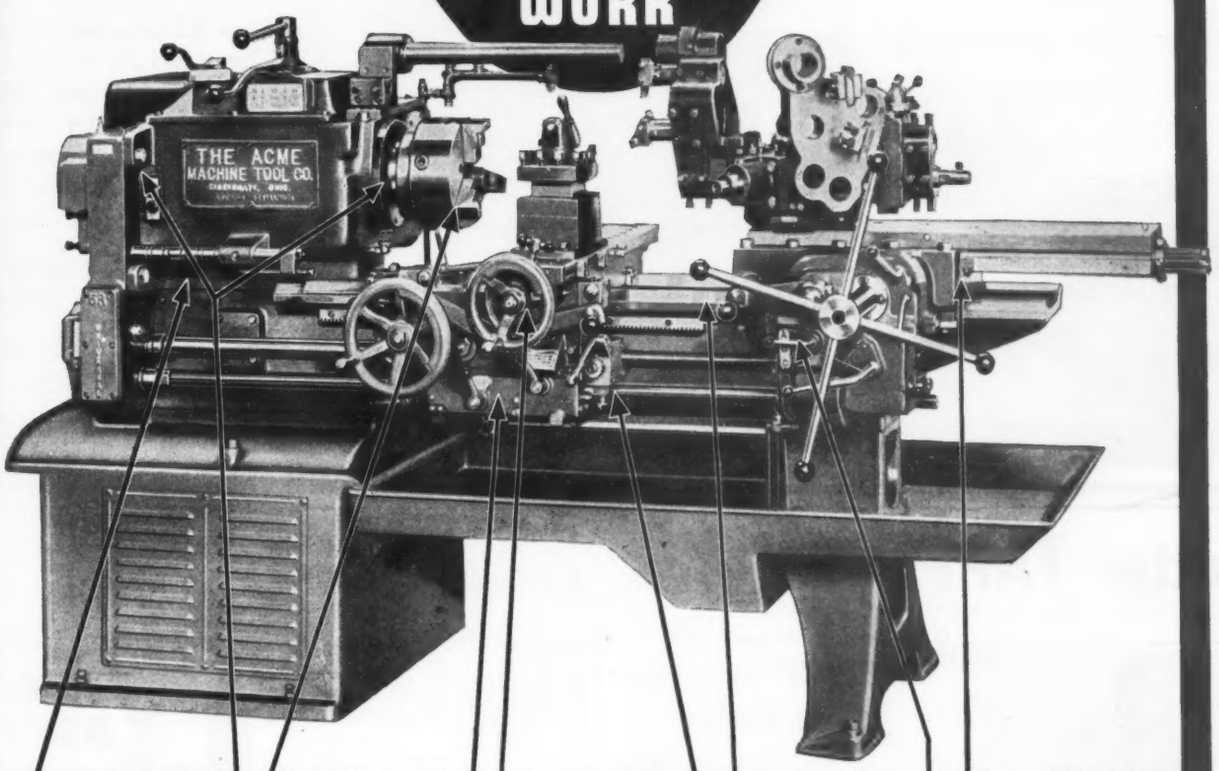
SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Arbor Presses • Vises
Sheldon-Vernon Horizontal Milling Machines • Vertical Milling Machines and Jig Borers • Shapers
4246 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U. S. A.

ACME *Ram Type* TURRET LATHE

for accurate, speedy - low cost

CHUCKING WORK



- NON-OVER HANGING HEAD STOCK
- THREE JAW UNIVERSAL CHUCK
- TWIN-NUT BACK LASH ELIMINATOR ON CROSS SCREW
- HARDENED STEEL VEE'S ON BED
- HARDENED STEEL RAM SLIDE BEARINGS
- TRIPLE ROLLER SPINDLE BEARINGS
- INDEPENDENT FEED RANGES FOR EITHER APRON
- SIDE CARRIAGE APRON TAPER GIBED TO FRONT BEARING ON BED
- INDEPENDENT FEED RANGES FOR EITHER APRON

This ACME Ram Type Turret Lathe as illustrated is tooled for chucking work. It is also equipped with chasing attachment for cutting from 4 to 32 threads per inch. This attachment is extra and furnished only when required.

This type machine when fitted with automatic chuck and power screw bar feed will accommodate round bar stock up to 2" on the No. 5R machine and up to 2½" round stock on the No. 6R machine.

All of the most important features necessary to maintain accuracy and speed at low cost are incorporated in this design.

For further information contact our engineering department. Write for Bulletin G107A.

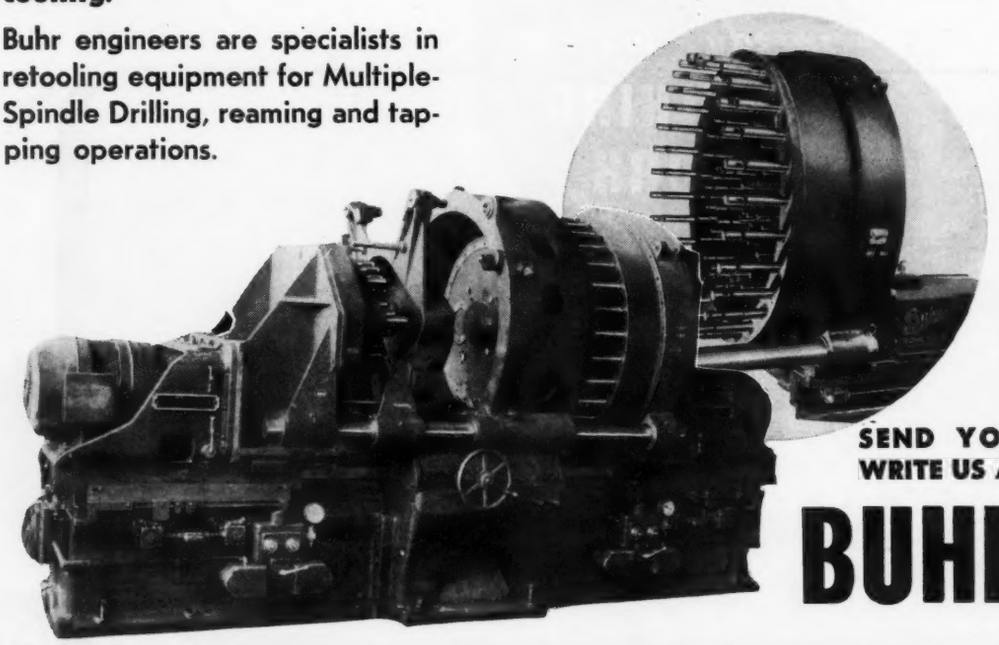
The ACME MACHINE TOOL Co.

CINCINNATI 32, OHIO

GIANTS of PRODUCTION!

Look ahead . . . get ahead . . . keep ahead with Buhr Retooling.

Buhr engineers are specialists in retooling equipment for Multiple-Spindle Drilling, reaming and tapping operations.



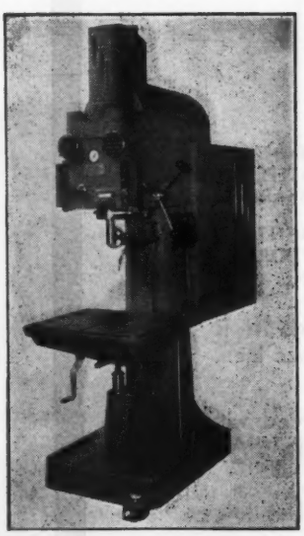
by **BUHR**

Retooling consists of a fixture for clamping part. Right hand head (above) has 82 spindles; left hand head has 38 spindles with a sliding bushing plate for removal of part from fixture. Heads have oil pumps for positive lubrication and shaved gears for quietness.

SEND YOUR BLUE PRINTS OR WRITE US ABOUT YOUR PROBLEMS

BUHR MACHINE TOOL COMPANY
843 GREEN & DAVIS
ANN ARBOR, MICH.

Better TAPPING Faster



on a Model DB CLEVELAND Automatic Tapping Machine

Give your tap a chance to produce better threads. Our lead screw completely controls the thread accuracy through the entire tapping cycle, taking the load off the tap—Class 3, 4 and 5 gauge fits are therefore being produced on a production basis.

Five Outstanding Features

- LEAD SCREW CONTROLLED
- 100 PER CENT AUTOMATIC
- PRECISION DEPTH STOP
- SENSITIVE SLIP CLUTCH
- SPLIT SECOND REVERSE

Full Descriptive bulletin available. Write for your copy today.

CLEVELAND
LEAD SCREW
TAPPING MACHINES
★
THE CLEVELAND TAPPING MACHINE CO.
3610 SUPERIOR AVE., CLEVELAND 14, OHIO

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for Continuous

PRODUCTION

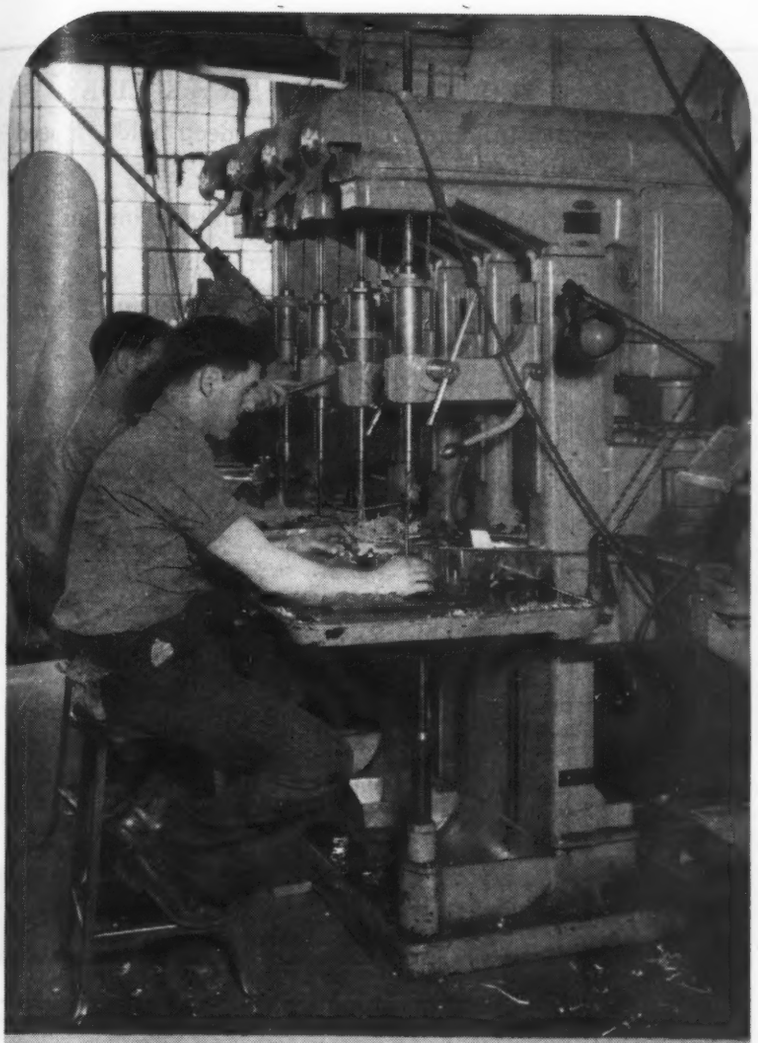
HIGH DUTY

Kaufman No. 10A Hi-Duty single spindle Lead Screw Tapper, made in 3 HP and 1½ HP models, with ¾" N.C. and 1¼" N.C. Threads in alloy steel, offers these features:

Fully enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wear-proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable.

COMPLETE INFORMATION UPON REQUEST

KAUFMAN MFG. CO.
MANITOWOC, WISCONSIN



Handles Drilling and Reaming Operations Faster

FOSDICK High Speed DRILL

● When you have work requiring holes up to 1¼" diameter you will get them faster within prescribed tolerances on a Fosdick High Speed Drill.

Here's a high speed machine for drilling – reaming – counterboring – and tapping operations that is turning out accurate work at low cost in hundreds of plants.

For example the four spindle machine shown is drilling and reaming holes of various diameters in aircraft parts. The work moves in jigs from one spindle to another and several operations are completed before work is removed from jig.

The unusually wide range of speeds available—the ease with which they are changed—the simplicity of operation make this sturdy drill popular for small hole drilling.

Furnished in single or multiple spindles up to six with center distances ranging from 12 inches up to 36 inches.

Complete information on various combinations is contained in the Fosdick High Speed Drill Bulletin H. S. M. Available upon request – write for yours.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23. . . . OHIO

HOEFER MILLING HEADS

Counterbore

24 . . . 2½" DIA. HOLES IN 7.8 SECONDS . . . . .

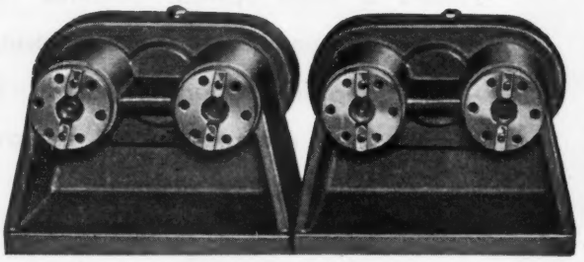
COUNTERBORING TRACK LINKS

2½ in. diameter by ⅜ in. deep holes. Speed 40 feet per minute—61 r.p.m.

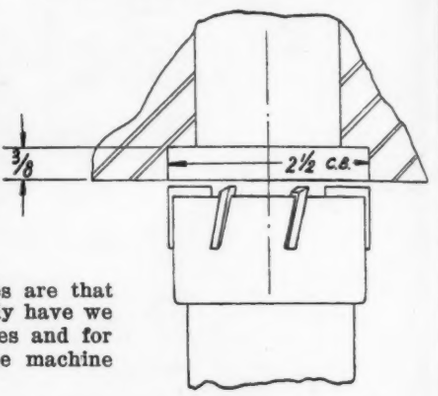
6 tooth cutter cuts .048 in. per revolution.

2.928 feet penetration per minute.

⅜ in. depth—7.8 seconds actual machining time for both counterbores.



Two of a group of twelve two-spindle milling heads arranged for mounting of counterboring milling cutters with standard key drive for counterboring Track Links. The spindle construction is that of standard milling machine type.



Write and tell us of your needs and we will make recommendations.

NO matter how difficult your problem may seem to you the chances are that we have furnished Multiple Spindle Heads for similar use. Not only have we built heads for mounting on drill presses but also on rotating spindles and for mounting on the turret of turret lathes motivating them through the machine spindle containing the work.

Hoefer Heads not only increase production per hour but decrease cost of drilling or allied operations . . . also they increase production from the same floor space (no new machinery needed) and decrease handling time.

Hoefer's Whole Business is Holes . . . . **HOEFER MFG. CO.** *Freeport, Ill.*

TIME-SAVING MACHINE TOOLS SINCE 1901

Moline Tool Company since 1901 has been designing and building machine tools of the highest degree of efficiency for these operations:

- Boring—rough, semi-finish and finish
- Honing
- Milling—(special machines)
- Straight Line Drillers
- Universal adjustable spindle drillers
- Way Type Machines—horizontal and vertical drilling, tapping and boring machines

"Hole Hog" machine tools are versatile—their construction makes possible easy change-over to other jobs. They are easy to operate and are ruggedly built for years of continuous production service. For man-hour savings—for more efficient, smoother work—look to Moline machines.

Write for information concerning machine tool equipment for your special problems.

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

MOLINE TOOL COMPANY

107 20th Street MOLINE, ILLINOIS

The Drill with a Hundred and One Speeds

All Speeds Instantly Available While Machine Is Running

M-125—⅜ Cap.
M-96—⅞ Cap.
1 to 6 Spindles.

Correct speed at the turn of a knob.

Speed Chart on front of head.

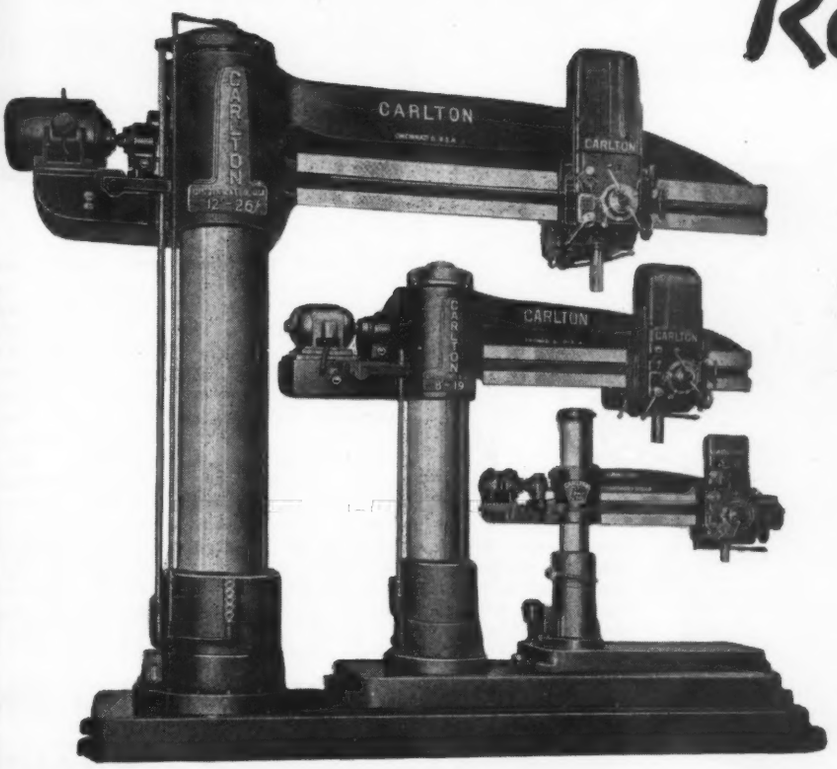
Ability to obtain exact speed for diameter of drill and material to be used results in less breakage, fewer grinds and higher efficiency.

•

Write for Circulars.
MM-125 MM-96

THE TAYLOR & FENN CO., Hartford, Conn.

CARLTON *Radials*



The Carlton Machine Tool Co. offers a complete line of Radial Drilling Machines in sizes ranging from 3′ arm to 12′ arm, and from 9″ dia. column to 26″ dia. column. Carlton Radials are delivering outstanding service in almost every large manufacturing plant in the country, as well as railroad shops, shipyards, steel mills, etc. Carlton all-ball-bearing construction with original low-hung drive to spindle makes operation—even under heavy loads — smooth, vibrationless and chatter-proof. Many other modern features available. For greater production, greater economy and satisfaction . . . . investigate Carlton Radials today!

THE CARLTON MACHINE TOOL CO.
CINCINNATI, OHIO

HIGH SPEED TAPPING . . . WITH *AUTOMATIC* TAP PROTECTION

The New PROCUNIER "TRU-GRIP" Tap Holder

A new practical tap holder with many advantages. A broached section of the chuck receives the flattened surfaces on the spring collet, while the tap has a positive drive through the square hole broached in the collet. The tap is always in true alignment — tap shanks are never scored or "chewed up."

Reduce Tap Breakage and Damage by Using a Procunier Tapping Head

The new Procunier sensitive high-speed tapping head allows fast, accurate tapping with a minimum of tap breakage. Driving power to the tap is automatically regulated by pressure applied to a special clutch. This double-cone, cork-faced, friction clutch engages the conical surfaces of the drive and reverse shells, driving the tap with a soft "cushioned" action. The high sensitivity of the clutch practically eliminates tap breakage. Operators can quickly detect dull or loaded taps by the "feel" or pressure required to drive them—also, the clutch instantly slips should the tap strike bottom or stick because of tap loading.

Send coupon for circular giving full details, specifications and prices.

PROCUNIER
SAFETY CHUCK CO.
16 S. CLINTON STREET
CHICAGO 3, ILL.

SEND FOR BULLETINS

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St., Chicago 3, Ill.

Please send me free bulletins on ☐ Procunier High Speed Tapping Heads ☐ Procunier Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name.....

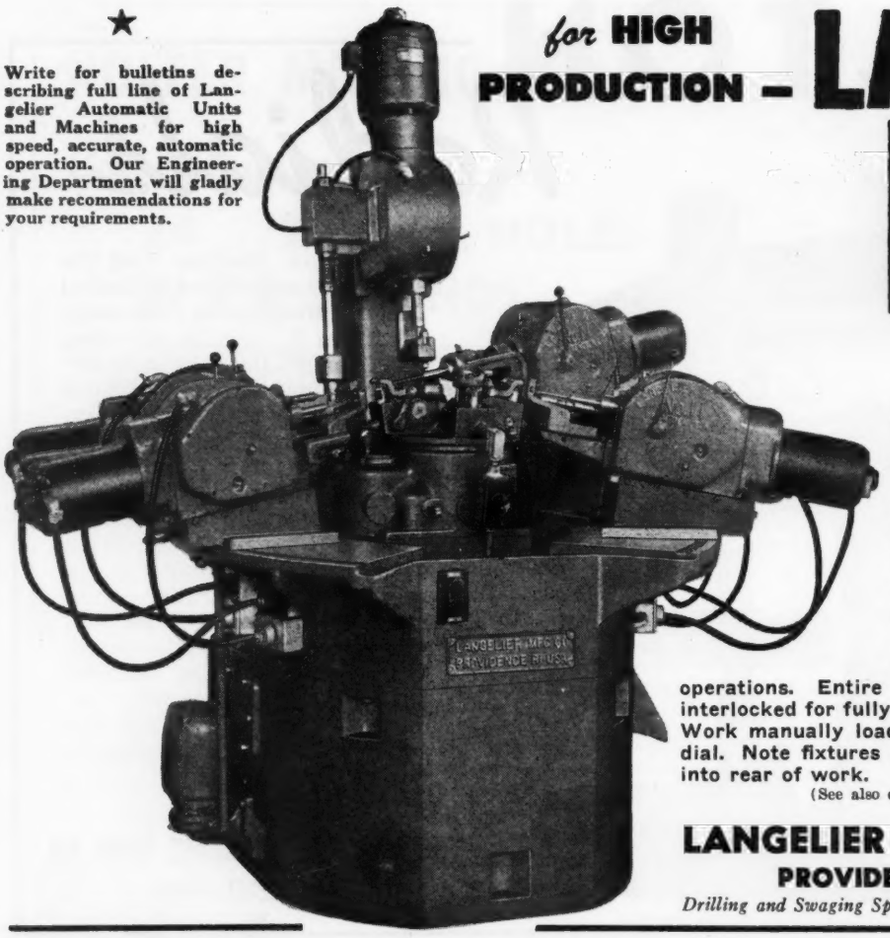
Address.....

★

Write for bulletins describing full line of Langelier Automatic Units and Machines for high speed, accurate, automatic operation. Our Engineering Department will gladly make recommendations for your requirements.

for **HIGH PRODUCTION** – **LANGELIER**

AUTOMATIC UNITS *for* **MULTIPLE DRILLING TAPPING ETC.**



Speed and efficiency are contributed to multi-operation production by LANGELIER Automatic Units arranged in various combinations. Typical is the Special Machine at left, which handles drilling, grooving, tapping and counterboring operations by means of five Langelier Drilling Units and one Tapping Unit. (Also available: milling, reaming, spotting, chamfering, etc.) Multiple Spindle attachable Langelier heads may be mounted on feed sleeves of each Unit for combinations of these operations. Entire machine, as illustrated, is electrically interlocked for fully automatic operation and central control. Work manually loaded and clamped in fixtures on 4-station dial. Note fixtures mounted at 10° angle to permit drilling into rear of work.

(See also our Swager advertisement in this issue.)

LANGELIER MANUFACTURING CO.

PROVIDENCE • RHODE ISLAND

Drilling and Swaging Specialists for Over 50 Years . . . Incorporated 1887

Speeds-Up Production... Cuts Welding Cost

VICTORY *Automatic* Seam Welder

6 Advanced Features give you better welded tubing . . . faster, and at lower cost!

Model 0412

The VICTORY Automatic Seam Welder opens vast new opportunities to increase welding output and slash production costs! Designed for wartime industrial needs, this machine has been further improved to provide manufacturers using many types of seam-welded tubing the advantages of Continuous, Low-Cost welding operation.

1. Delivers up to 150" per minute of uniform, tight, straight welds.
2. Takes 4" to 12" dia. pre-formed tubing, 18 ga. to 3/16" wall thickness.
3. No splatter of metal—eliminates wasteful weld grinding and finishing.
4. Chain-type drive prevents work slippage while passing under welding head.
5. Efficiently employs Union Melt, Lincolnweld, or other types welding.
6. Designed for Rounds, Squares and other shaped tubes.

Write for more information concerning the VICTORY Automatic Seam Welder. Our engineers are ready to consider its application to your particular problem. There's no obligation.

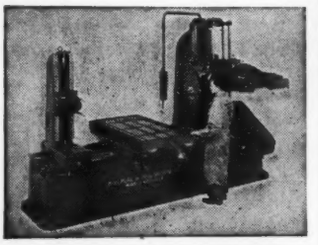
VICTORY ENGINEERING & MACHINE WORKS, INC.

3000 Chouteau Ave., St. Louis 3, Mo.

UNIVERSAL Horizontal Boring Machine

The only **TRIWAY** Boring Machine Built

Made in 3", 4" and 5" spindle sizes. Write for complete, detailed specifications. Represented throughout South America by Machine Affiliates.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.

Hudson, Mass., U. S. A.

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.

CLEVELAND, OHIO, U. S. A.

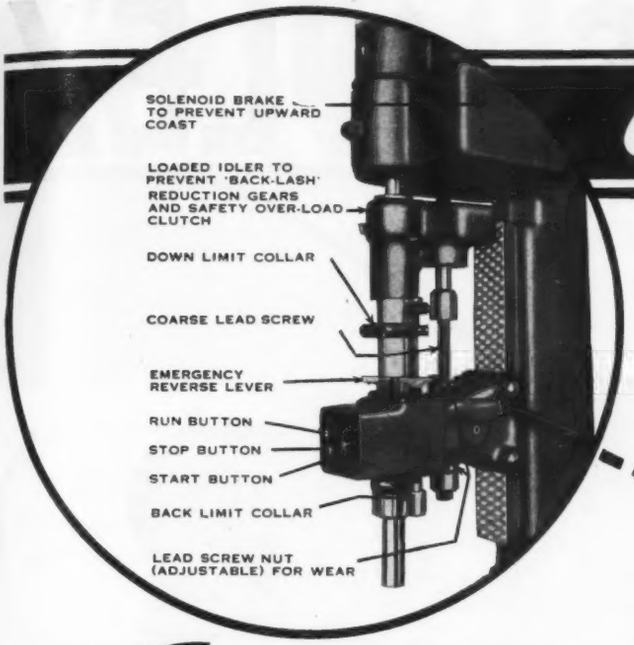
NOW AND ALWAYS OF

FACE WHILE BORING

M-D Facing Head can be attached to Column Boring Mill Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically. 10 sizes, 6" to 46" dia. Write for descriptive bulletin and prices.

MUMMERT-DIXON COMPANY

HANOVER, PA.



Avey FEATURE No. 3

THE *Avey* TYPE MA-6

AVEY-MATIC POWER FEED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

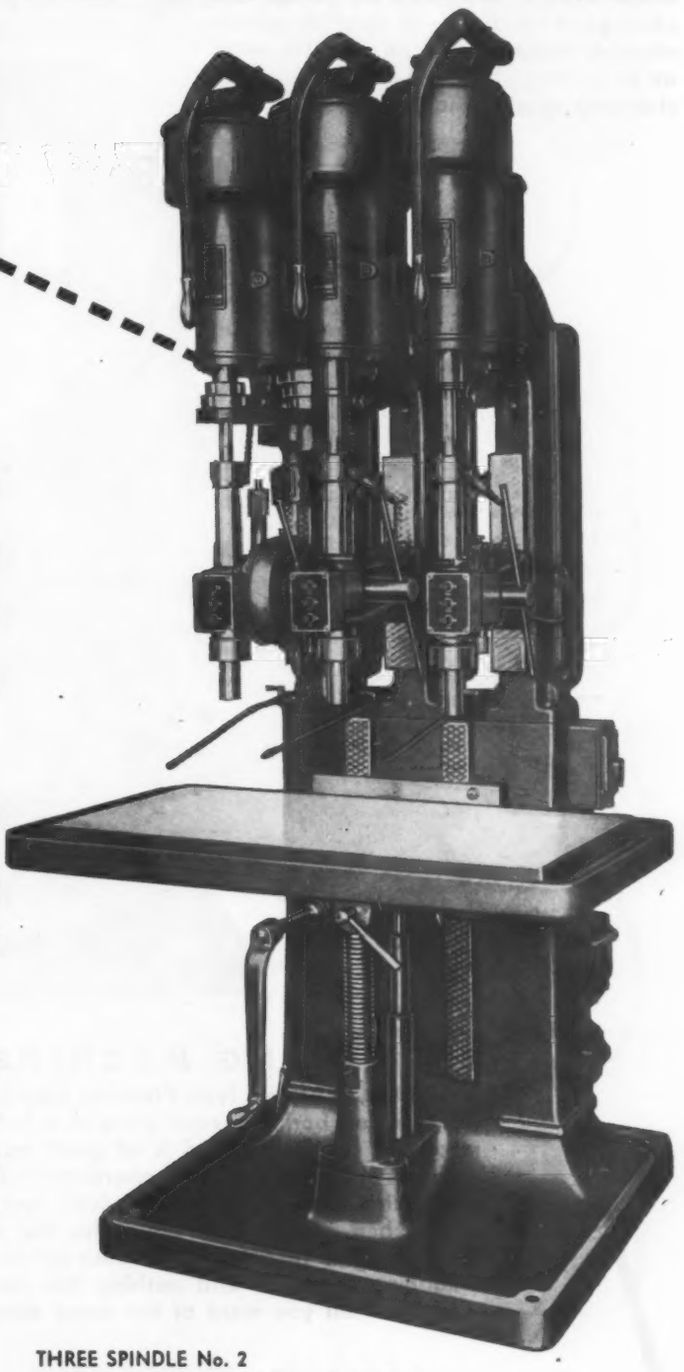
features

reversing motor, positive lead screw tapping — for accurate thread and tapping in soft material or thin sheets

Dog control for depth — maintaining accuracy of depth within one-half revolution of the spindle — or emergency relief lever used to reverse motor if necessary before tapping cycle is completed.

Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1¼" capacity in cast iron.

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.



THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

SIMPLEX

The shop which builds a variety of products in varying size lots, needs something much more flexible than the conventional type of precision boring machine. It must be able to handle jobs both large and small with a minimum of set-up and change-over time. It must be quickly aligned, equipped with an accurate method of spacing holes and a quick means of changing speeds and feeds.

THE BORING MACHINE FOR A THOUSAND JOBS

A SIMPLEX 3U Knee Type Precision Boring Machine is here shown with an indexing fixture for precision boring several parts in a heavy transmission. The hole sizes differ, so a quick means of changing speed is of great advantage. Various fixtures are used which can be made of the most desired proportions and the machine adjusted to suit the work. Boring and facing feed changes are quickly and conveniently made by means of the star knobs on the bed. All controls are within the operator's easy reach. One of the most valuable features is the fact that when once set up for a job, operation is reduced to loading and unloading the work and pushing the starting button. Let our representative study your work and tell you more of the many advantages of these advanced designs.

Precision Boring Machines

STOKERUNIT CORPORATION

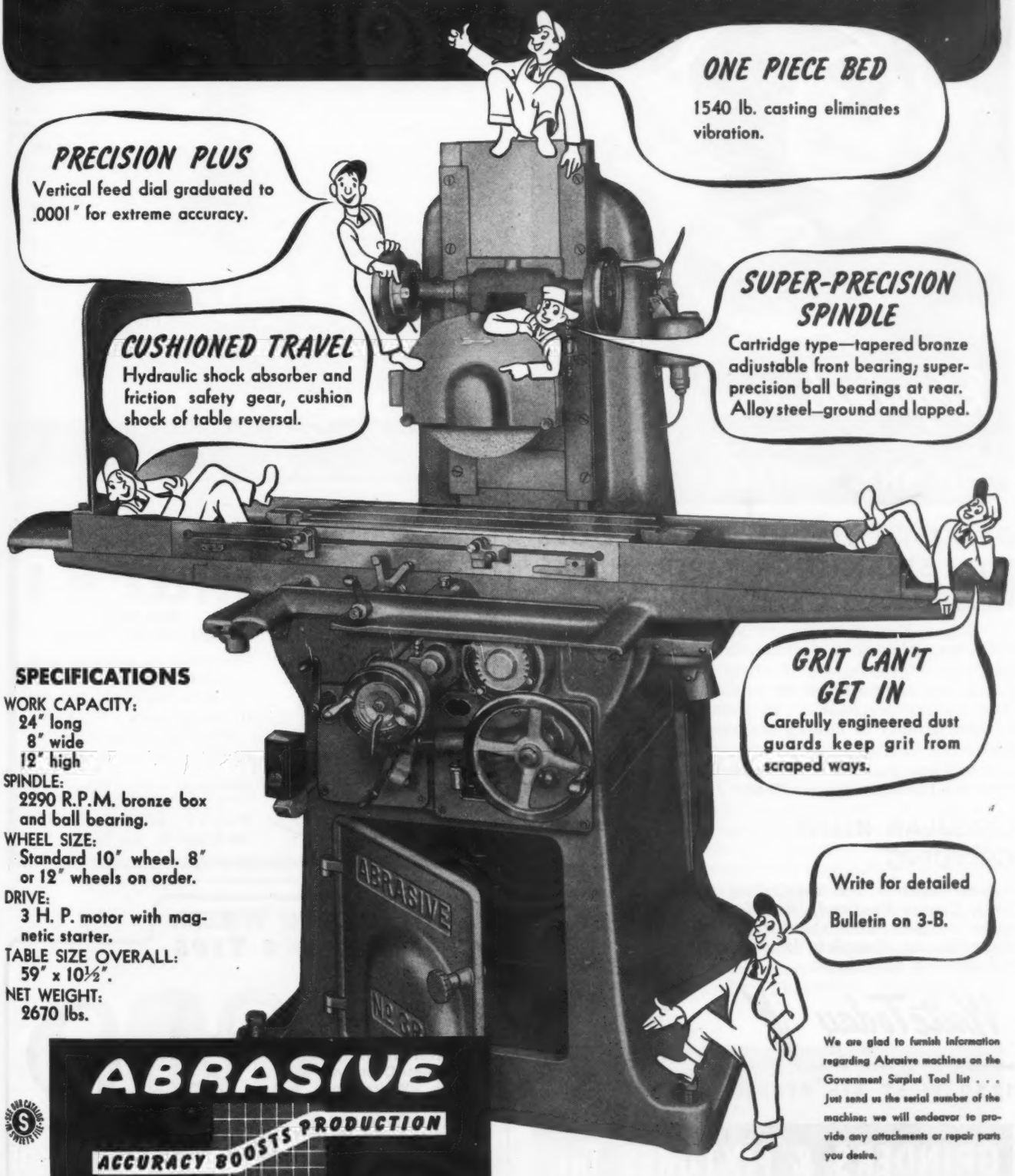
SIMPLEX Precision Boring Machines and Planer Type Milling Machines

4526 West Mitchell Street, Milwaukee 14, Wisconsin

ABRASIVE No. 3B

AUTOMATIC SURFACE GRINDER

A TOP PERFORMER ON THE PRODUCTION LINE AND IN THE TOOL ROOM



ONE PIECE BED

1540 lb. casting eliminates vibration.

PRECISION PLUS

Vertical feed dial graduated to .0001" for extreme accuracy.

SUPER-PRECISION SPINDLE

Cartridge type—tapered bronze adjustable front bearing; super-precision ball bearings at rear. Alloy steel—ground and lapped.

CUSHIONED TRAVEL

Hydraulic shock absorber and friction safety gear, cushion shock of table reversal.

GRIT CAN'T GET IN

Carefully engineered dust guards keep grit from scraped ways.

Write for detailed Bulletin on 3-B.

SPECIFICATIONS

WORK CAPACITY:
24" long
8" wide
12" high

SPINDLE:
2290 R.P.M. bronze box and ball bearing.

WHEEL SIZE:
Standard 10" wheel. 8" or 12" wheels on order.

DRIVE:
3 H. P. motor with magnetic starter.

TABLE SIZE OVERALL:
59" x 10½".

NET WEIGHT:
2670 lbs.

ABRASIVE

ACCURACY BOOSTS PRODUCTION

We are glad to furnish information regarding Abrasive machines on the Government Surplus Tool list . . . Just send us the serial number of the machine: we will endeavor to provide any attachments or repair parts you desire.

ABRASIVE MACHINE TOOL COMPANY EAST PROVIDENCE 14, RHODE ISLAND

NOW AVAILABLE FOR IMMEDIATE DELIVERY

THE *New* CLEVELAND INDEX HEAD

Regrind YOUR TOOLS IN EXACT CONCENTRICITY ON ANY SURFACE GRINDER

DESIGNED TO HOLD ALL TOOLS WITH STRAIGHT OR TAPER SHANKS FROM 1/16" To and incl. 1-1/2" Diam.

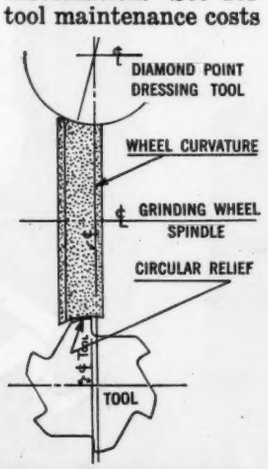
No longer need you discard your taps, reamers, end mills, etc., when they become worn or damaged.

360 degree graduations in three planes enable you to grind any desired angle or cutting edge on your tools with factory precision . . . in your own shop . . . on any surface grinder or milling machine.

Write for catalog and complete information. See for yourself how you can reduce your tool maintenance costs with the Cleveland Index Head.

CIRCULAR RELIEF GRINDING . . .

A new method for regrinding tools. *Leaves No Land.* Ideal for spiral reamers, bent shank taps, end mills, etc. Complete data and information on request.



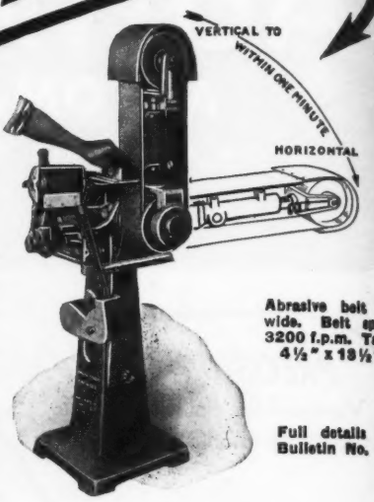
Write Today

1259 WEST 4th STREET

GRINDERS & FIXTURES Inc.

Cleveland 13, Ohio

This DOES IT!



Abrasive belt 4" wide. Belt speed 3200 f.p.m. Table 4½" x 13½".

Full details in Bulletin No. 4.

This feature enables the "PRODUCTION" TYPE S MACHINE to be used as a Centerless Feed Polishing Machine, as a Vertical or Horizontal Belt Grinder, Surfacer of Polisher—for any material that can be polished or ground! Cylindrical work ¼" to 1" in diameter may be fed automatically at a variable speed. For flat work, centerless feed may be swung back (see illustration) and for irregular work, where a flexible belt is needed, the flat surfacing bed may be removed. These special features will make TYPE S the most versatile machine in your plant.

Production

MACHINE COMPANY GREENFIELD, MASS. U.S.A.

QUALITY • SERVICE • DEPENDABILITY

DUPLEX M-6

HIGH SPEED BAND AND DISC GRINDER

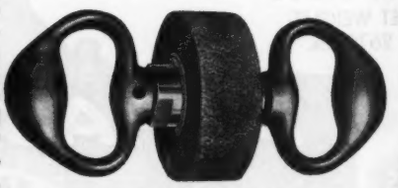
The latest in pedestal type grinders. Actually two machines in one! 14" disc for all rough work . . . 6 x 48' band for finishing. Precision-built to post war standards.

Other styles and sizes in New Booklet on Finishing. Write Today.

WALLS SALES CORP.
306 E. 38th St., New York 16, N.Y.

GRINDING WHEEL DRESSING TIPS

THIS IS CRACKERJACK, the newest ball-bearing grinding wheel dresser from the complete Desmond line. Write for Catalog "A", showing mechanical, abrasive and diamond dressers.

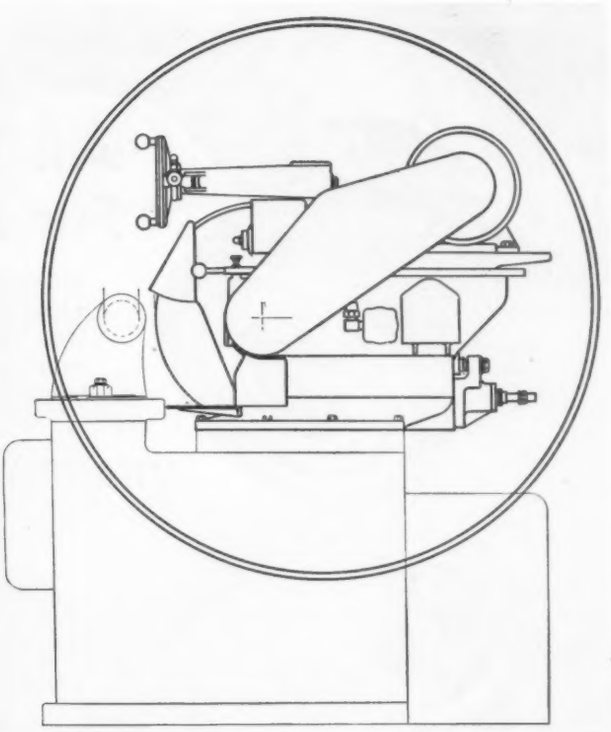


The Only Complete Line of Wheel Truing Equipment

There's a Desmond Dresser for every job.

DESMOND-STEPHAN MFG. CO., Urbana, O.

You too can have FITCHBURG *Automatic* PRECISION GRINDING *INEXPENSIVELY...*

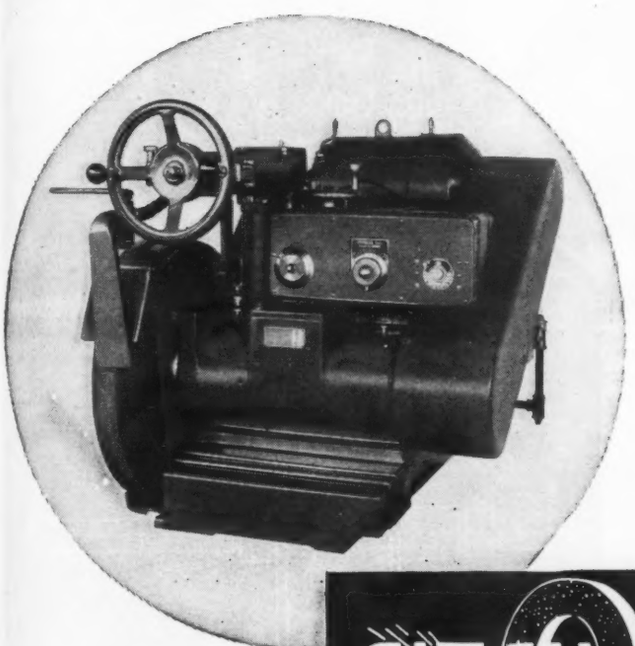


FITCHBURG Bowgage Head mounted on another make of grinding machine

...by installing FITCHBURG Bowgage Heads on the Grinders you now have.

Just as we did in the above case—and in many others—we'll be glad *to prove to your satisfaction* the ease, the simplicity, and the *inexpensiveness* of installing Fitchburg Bowgage Heads on your present grinders. With your grinding equipment thus modernized, the resulting mass production applied to your precision grinding will soon pay off the small cost involved.

The FITCHBURG Bowgage Head is a self-contained grinding unit, with *all* its movements and controls within itself. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position—all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed—thus protecting your investment in grinding machinery. Fitchburg engineers will welcome the opportunity to help you solve your grinding modernization problem. There is, of course, no charge for this service. Send us the details—blueprints if available—and see how easily and inexpensively *you too* can have FITCHBURG AUTOMATIC PRECISION GRINDING in your shop.



FITCHBURG
BOWGAGE HEAD

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders

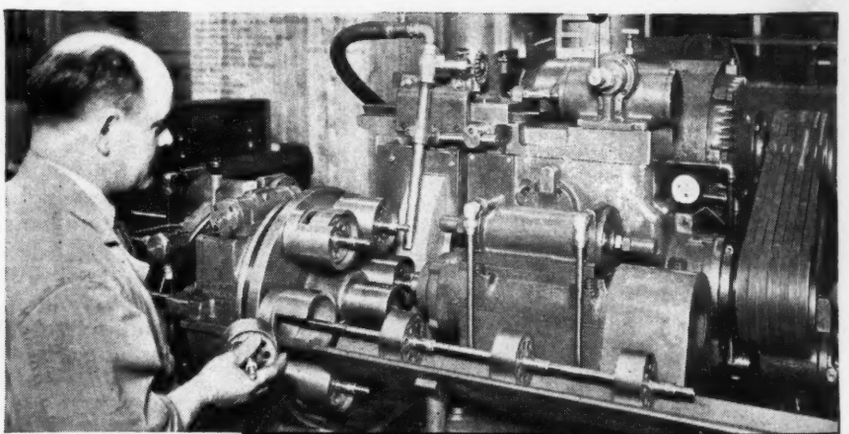
All Types of WHEELS For All Types of WORK

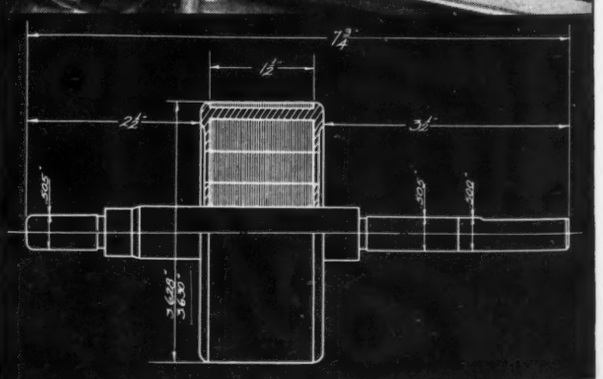
All types of wheels—for all types of work—on all types of machines. Take advantage of our specialized service. Let us help you select wheels for maximum economy and efficiency on every job.
BORITE, CARBORITE, SILICATE-, SHELLAC-, RESINOID-BONDED WHEELS.

VITRIFIED WHEEL CO.
WESTFIELD, MASS.

Another outstanding cylindrical grinding job by

ARTER





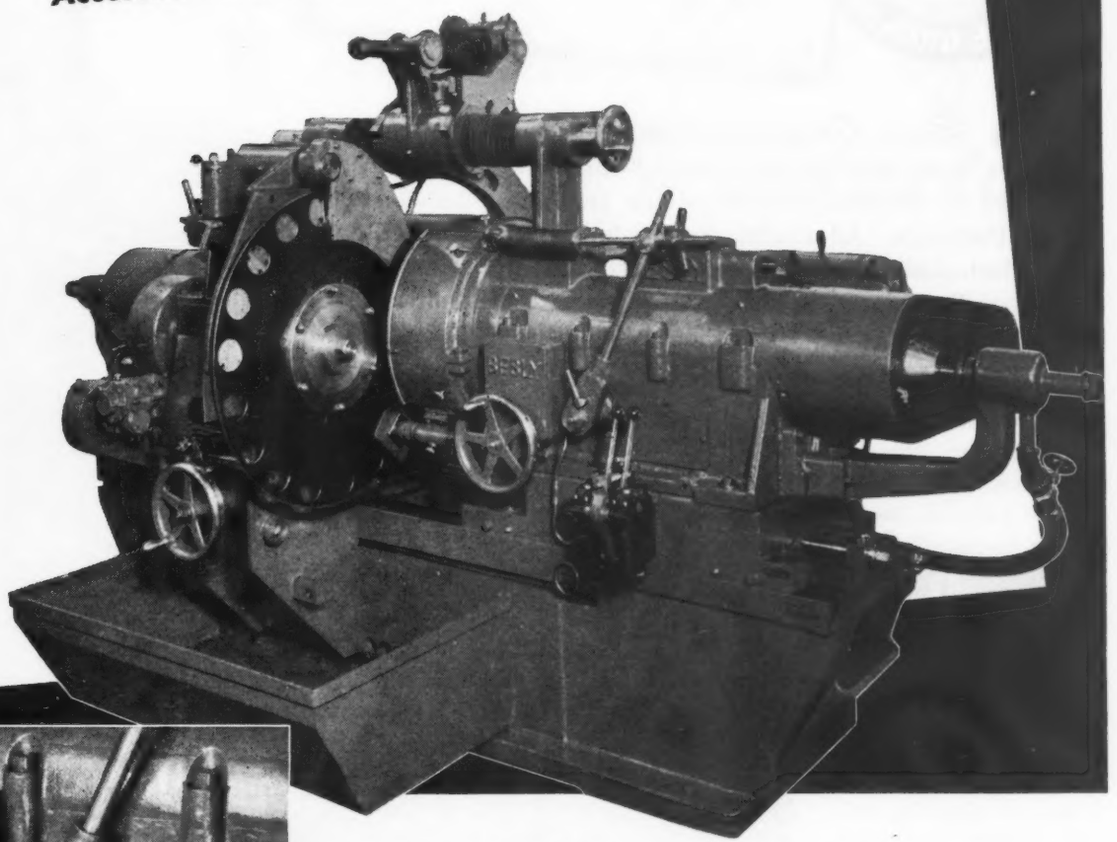
No. 135 Automatic Cylindrical Grinder

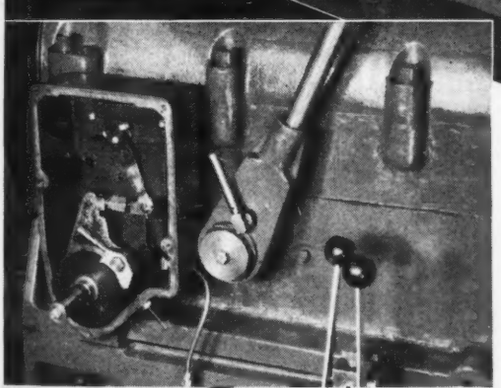
The grinding of the diameter of the laminations of an armature for a washing machine motor is one of the many jobs on which this machine is giving typical ARTER satisfaction. Production—200 pieces per hour. The central taper shaft diameter is ground before assembly with a production rate of 300 per hour.

ARTER GRINDING MACHINE COMPANY
WORCESTER, MASSACHUSETTS • U. S. A.

Now.. 400 GEAR BLANKS AN HOUR

Accurate for Size, Flatness, Parallelism and Finish!





Above: No. 226, 30" Besly Double Spindle Grinder with rotary feed for grinding gear Blanks plates of Monel Metal and Meehanite.

At left: Close-up of hydraulically-operated control conveniently located for fine wheel adjustments. Grinding wheels can be adjusted up to .0001 if desired.

BESLY GRINDERS

If you are buying
BESLY GRINDERS
from U. S. Government Surplus Stocks
ask us to help you select and adapt such machines to meet the specific needs of your production.

In the production of cover plates and gear blanks for a 2-stage fuel unit pump, Besly's "226-30" Grinder produces 400 finished pieces an hour within a tolerance of .0002 for parallelism, flatness and size—under a ten micro-inch finish. Total stock removed is .70" to .090"—at rate of 1,600 passes an hour—four passes required per piece. Former method gave less than half this production without close tolerance for flatness, parallelism and finish. Besly Grinders are easily adapted to a wide variety of specialized production.

Besly engineers will galdly help you to select the right grinder to do your work with speed and precision—*at the lowest cost possible. Why not look into the possibilities? Write today.*

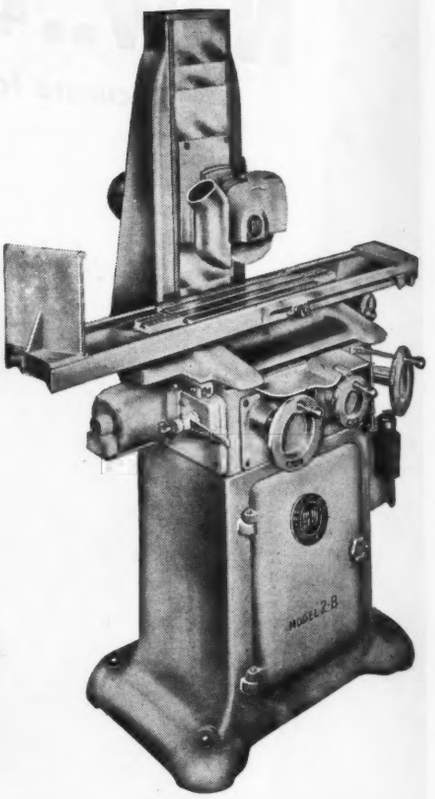
BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHAS. H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill., Factory: Beloit, Wis.

PRECISION REID SURFACE GRINDERS

CONTROLS
"at Your Fingertips"



It's a Rare Occasion when replacement parts are necessary for Reid PRECISION Surface Grinders. Moving parts are mounted in Timken Tapered Roller Bearings, Ball-Bearings and Oilite Bushings. All shafts are hardened and ground. Efficient, Simplified, Lubrication. These important features assure you exceptional Precision results, extra long wearing qualities, and ease of operation with controls "At Your Fingertips."

ILLUSTRATED IS THE REID MODEL 2B ALL ELECTRIC POWER-FEED.

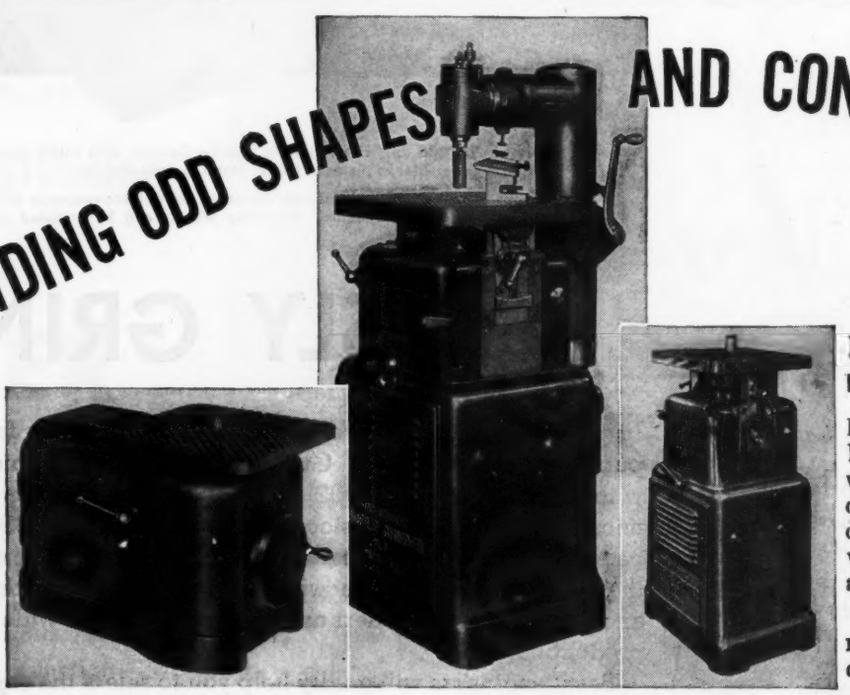
The Reid Model 2-C Hand-Feed also is an Exceptionally Fine Machine for Tool, Gage, Die and Certain Production Grinding.

MACHINES EQUIPPED FOR WET GRINDING IF REQUIRED.
EXCELLENT DELIVERIES.

Distributors Conveniently Located in All Sections.
Write Dept. B for Illustrated Bulletin and Prices.

REID BROTHERS COMPANY, INC.
BEVERLY MASSACHUSETTS

FOR GRINDING ODD SHAPES AND CONTOURS



No. 1
PROFILE GRINDER

A bench size tool operating at 20,000 R.P.M. with vertical oscillations. For grinding die clearances, sharpening punches and economically finishing cams and templates.

In production grinding too, this Grinder has proved a valuable tool.

Boyar-Schultz Grinders are designed and built for grinding and finishing irregularly curved surfaces and contours so frequently encountered in the tool room and die shop. Dies and punches, templates, cams and special parts are finished with time-saving speed.

No. 2
PROFILE GRINDER

Dual Spindle Model. Larger floor model with two independently powered spindles, operating with vertical oscillations at 10,000 R.P.M.

A rapid stock remover even with small diameter wheels.

Single Spindle Model with lower spindle only. A tool that has demonstrated its value in the tool and die shop.

BOYAR-SCHULTZ CORPORATION

WALNUT STREET AT HOYNE **CHICAGO 12, ILLINOIS**

A TOOLROOM *Well Equipped*

IS THE *Backbone of Production*

Here is the **POINT!** **TO USE**

OLIVER OF ADRIAN PRODUCTS

The Oliver 510 Drillpointer was perfected on the theory that Twist Drills should always be machine sharpened for efficient production. When properly machine ground a Twist Drill will cut faster, last longer and produce more holes per grind.

Excessive costs of scrap materials and tools have been eliminated by use of the Oliver of Adrian Drillpointer.

OLIVER'S 510 DRILLPOINTER

covers the entire range of drills from ¼" to 3" with variable clearance and point angles providing points that give greater clearance with less chisel point angle . . . thrust is reduced . . . uniformity maintained . . . each drill point is exactly the same as every other drill point.

•

Test the "Oliver Point" in your own shop . . . Send us some Drills; we'll sharpen them for you at no cost.

•

Write for Illustrated Literature

OLIVER INSTRUMENT CO.

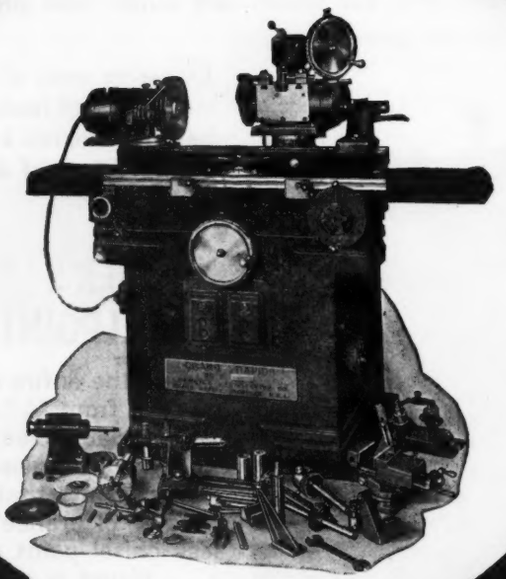
1410 E. MAUMEE ST. • ADRIAN, MICH.

Don't Neglect Your Toolroom It's the Backbone of Production!

Oliver OF ADRIAN

AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

GRAND RAPIDS No. 600 UNIVERSAL Cutter-Tool GRINDER



Features

Cabinet Base Construction — Ball Bearing Table — Hardened and Ground Ways — Fixed Table Height — Cross Movement on Column enables operator to stand close to Machine at all times — Convenient Location of all Controls — All Wheel Shafts mounted on Grease-sealed Ball Bearings — One Shot Lubrication — Provision for Built-in Dust Collector.

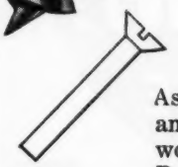
Full Description
IN BULLETIN 10-1-43

GALLMEYER & LIVINGSTON CO.
305 Straight Ave., S.W., Grand Rapids 4, Mich.

Wood Screw Machinery

Convert wire into finished screws with a COOK Open Die Header and the two machines described below

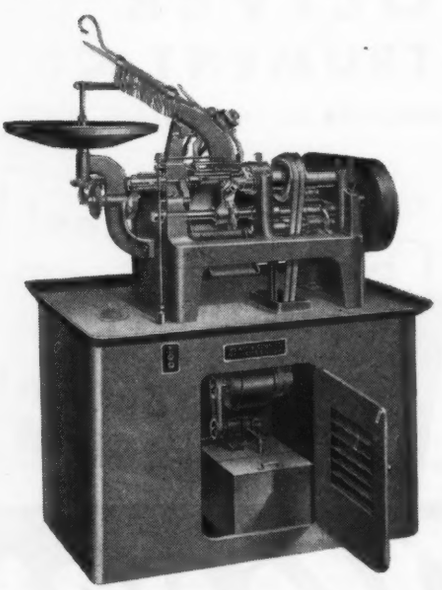
SHAVER and SLOTTER



Asa S. Cook Automatic Hopper-Fed Shaver and Slotter Machines finish the heads of wood screw blanks in all standard sizes. Both shaving and slotting operations are performed simultaneously . . . production is high speed and all standard head types are produced.

THREADER and POINTER

The Automatic Hopper-Fed Machine, shown below, threads and points screws, rapidly and efficiently, handling blanks from the Shaver and Slotter. Equipment is complete and includes coolant tank, pump and necessary piping. Machines are compact and require little floor space.



Three different machine sizes produce the complete range of screws (No. 0 x ¼" to No. 30 x 6").

Write for complete information.

ASA S. COOK COMPANY
1460 ELMWOOD AVE., PROVIDENCE 7, R. I.

New JKS

INDUSTRIAL DIAMOND TOOL Catalog

The new J. K. Smit & Sons fact-packed catalog, is just off the press. Printed in two colors, this plastic-bound 64-page book is extensively illustrated and contains useful information on diamonds and truing and dressing of abrasive wheels . . . interesting diagrams . . . descriptions and photos of all types of industrial diamond tools. Twenty pages of Standard Tools made for machines of different makes are listed by equipment manufacturers' names. Send for your free copy on your company letterhead.

CONTENTS

STA-KOOL TOOLS
READYSET TOOLS
DYKON GAGE
STANDARD TOOLS
SINGLE POINT TOOLS
CLUSTER DIAMOND TOOLS
FORM DRESSING TOOLS
SHAPED TOOLS
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and many other items

J. K. SMIT & SONS, Inc.

157 Chambers St., New York 7, N. Y.
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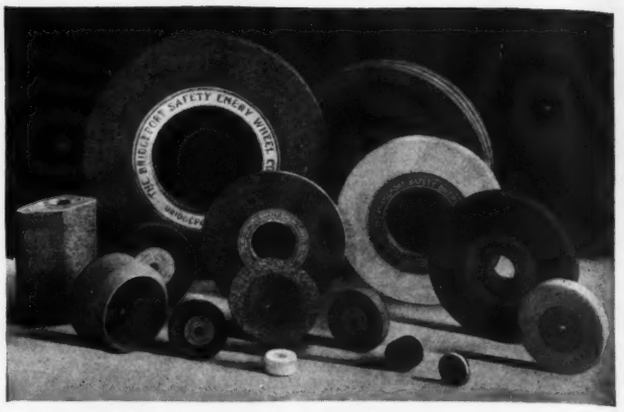
129 Adelaide St. West, Toronto, Ont.

THE RIGHT WHEEL FOR EVERY GRINDING NEED



"Bridgeport" ALUMINA Wheels—Aluminous oxide abrasive—hard, tough, sharp—for grinding materials of high tensile strength. Cool, free cutting.

"Bridgeport" LC ALUMINA Wheels—Refined aluminous oxide, for certain types of surface grinding.

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"Bridgeport" VITRIFIED Bond — Abrasive fused in ceramic clay. A wheel of great strength. Grades for most grinding jobs.

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"Bridgeport" RESINOID Bond—Synthetic resin bond. A wheel of great strength. Rapid metal remover. For speeds up to 9,500 SFM in foundry work, and up to 16,000 SFM in cut-off work.

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A new "case hardening" process for all abrasive wheels. Grinds carbide and cast alloy cutting tools at substantially lower cost. Less heat, finer finish, no "loading." Ask for details.

THE BRIDGEPORT SAFETY EMERY WHEEL CO., INC., BRIDGEPORT, CONN., U. S. A.

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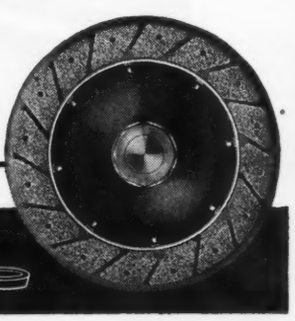

TIME Electro HIGH SPEED CUT-OFF WHEELS Against Anything

Wafer thin amazingly strong, "Electro" Cut-Off Wheels reduce cutting time from minutes to seconds; and make a further labor-saving time-gain by finishing cut faces as they whiz though wet or dry, hard or soft, heavy or light ferrous and non-ferrous metals, ceramic materials and such. They're the safest known, truest and best balanced.

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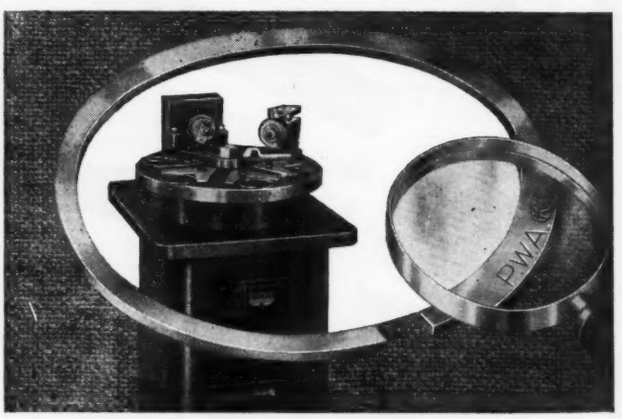


Precision Marking

Since the beginning of this century Noblewest engineers and craftsmen have devoted their efforts to Precision Marking at highest speeds and lower costs. As a result today's Noblewest machines are universally the standard for Rapid Precision Marking as exemplified by Model 183, shown above, designed especially for marking aircraft engine piston rings where distortion of thickness must be held to within .001 of an inch. Why not let us solve your marking problems? Whatever they are, we have the answers. Write Noble & Westbrook Manufacturing Co., East Hartford 8, Conn.

MARK IT BEST WITH

NOBLEWEST NOBLEWEST IMPROVED MARKING DEVICES

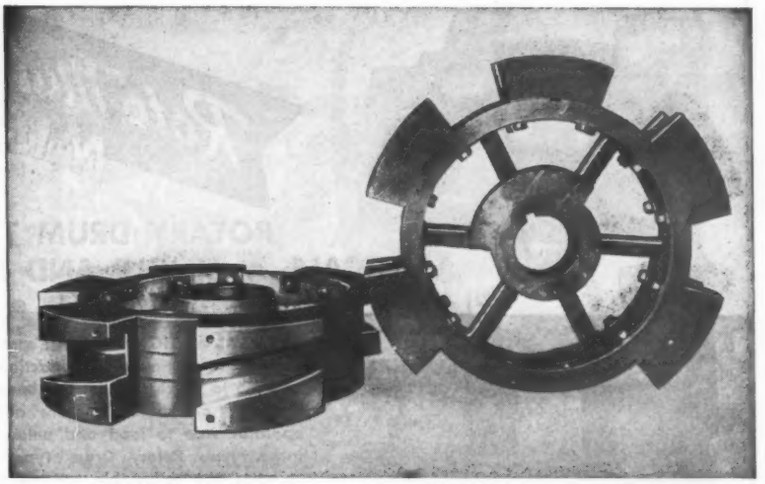
Hi-Speed Marking Machines

Appoint

ROWBOTTOM

Your

"CAM MILLING DEPARTMENT"



For expert service on every phase of cam design and production—let Rowbottom make your cams! As an example of Rowbottom skill we illustrate a cam made of steel segments fastened on a cast iron spider 18" in diameter with a 5-1/2" face. Cams of this type permit motion to be varied by changing segments. Perhaps a cam like this is the answer to YOUR present problems. But whatever you need, you can be sure that, with Rowbottom as your "Cam Milling Department," you will get cams that are right in design, dependable in performance and low in price.

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WATERBURY, CONNECTICUT, U. S. A.

Rowbottom for Cams

BETTER Small Part Production

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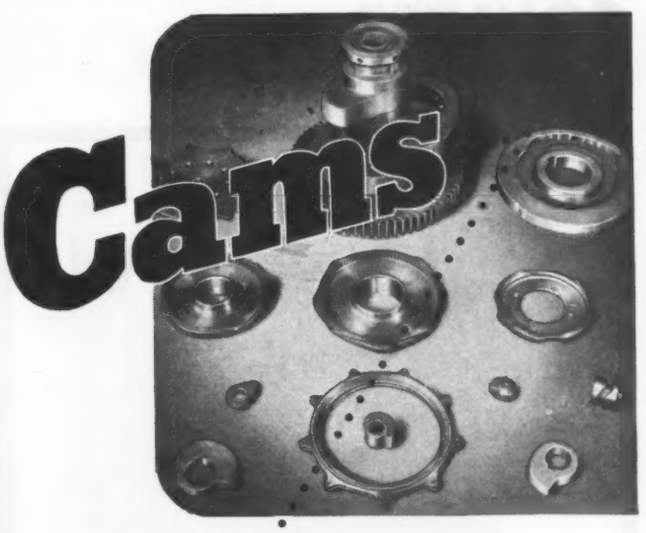
Get better production and release larger machines for large work! Use the FREW Hand Miller for accurate, economical production of small parts. Heavy construction and "big machine" features guarantee accuracy on heavy cuts. Table size 16¾" x 5¾" makes a wide range of work possible. V-belt drive and Timken-equipped spindle assure smooth operation at all speeds.

FREW

HAND MILLER

THE FREW MACHINE CO. 121 E. LURAY ST. PHILADELPHIA 20, PA.

Cams



● **25 YEARS** of experience in making special cams for thousands of companies has made us experts at cam cutting and grinding. Our facilities and equipment, the most complete of any plant in the country, permits us to manufacture any style or size of Cam, Geneva Motion, or Scroll Plate in quantities of 1, 10 or 10,000. Accuracy can be held to split thousandths, and surfaces to micro-finishes. Send us specifications or blueprints and we will be glad to submit a detailed quotation to you on your requirements.

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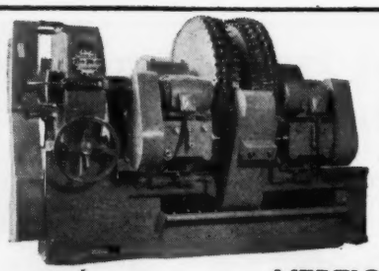
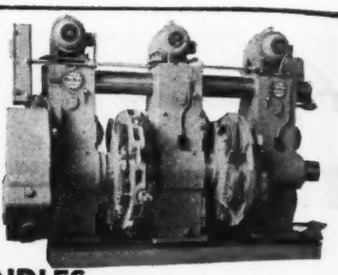
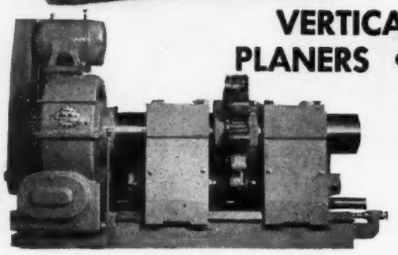


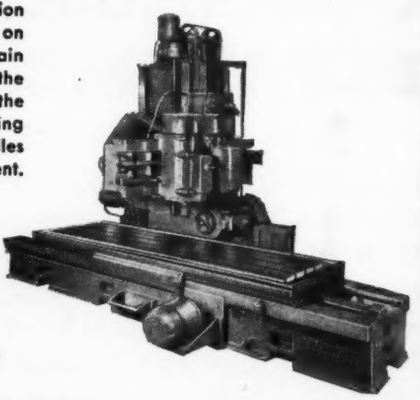
Roto-Matic MILLERS

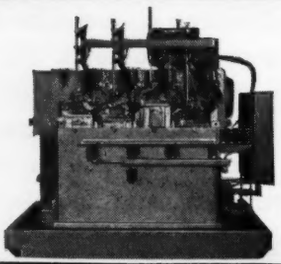


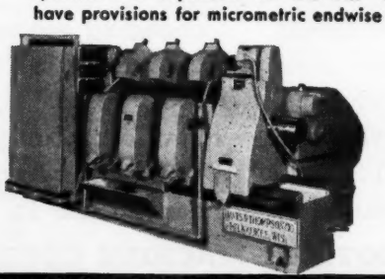
ROTARY DRUM TYPES •
VERTICALS • SINGLE AND MULTIPLE SPINDLES
PLANERS • RISE AND FALL • VERTICAL INDEXING



The ROTO-MATIC principle of continuous production insures the maximum of production and accuracy on any job to which a Miller has been adapted. Chain clamping mechanisms, where adapted, leave the operator free to load and unload parts. On the larger type Rotary Drum Type Millers finishing spindles are adjustable for toe cut. All spindles have provisions for micrometric endwise adjustment.







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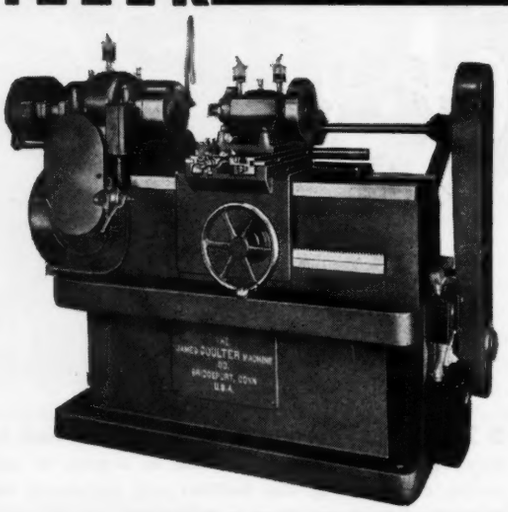
MILWAUKEE WISCONSIN

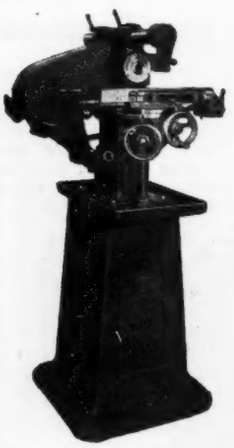
COULTER
HOB THREAD
MILLER



THREADS ANY PART THAT CAN BE CHUCKED

Large or small, long or short, internal or external jobs can be threaded quickly and accurately with the Coulter Thread Miller. Work and cutter spindle are driven by individual motors, providing a wide range of feeds and speeds. Write for further details of the infinite possibilities of this versatile machine.

THE JAMES COULTER MACHINE CO.
BRIDGEPORT 5 CONNECTICUT



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MILLING MACHINES and ATTACHMENTS

Designed especially for the profitable handling of small and difficult work on a production basis. Burke Milling Machines are available in sizes Nos. 1, 2, 3, and 4, all motor driven.

Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

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GRAHAM MULTI-PURPOSE VISE

Perfect as a plain vise—swell as a ready-made jig or fixture with all sorts of stops, guides, special jaws, etc. Sizes up to 124 lbs. for drill press, radial, shaper, planer, miller, grinder.

REQUEST NEW BULLETIN 41
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28 BRIDGE STREET
EAST GREENWICH, R. I.

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Strand Flexible Shaft machines have answered the call for portable, rotary power with efficiently designed, solidly constructed flexible shaft machines that insure constant speeds with dependability and greater operator convenience.

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Type M5

Strand FLEXIBLE SHAFTS

N. A. STRAND & CO.

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"ARMORED"

Flexible Shafts

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- Makes core run more smoothly.
- Transmits more power.
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- Protects piano wire core from frictional contact.
- Prevents core crystallization—prolonging life.
- Insures cool and truer - running shafts, free from vibration.

When you need a replacement shaft, see that it is a WYCO. Turn that extra motor into a flexible shaft machine with a WYCO—¼ HP Shaft 6 ft. long complete with coupling to fit your motor—$28.25—other sizes from ¼ to 2 HP. Remember WYCO Shafts include the greatest advance ever made in flexible shafting—the WYCO Patented Non-Metallic Innerliner (left). *There are no kicks about shaft breakdowns when it's a WYCO.*

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• High quality engineering design and manufacture enable Smith & Mills Crank Shapers to handle easily all types of jobs within the individual machine's range with precision and power to spare. A wide range of feeds and speeds, plus simplicity of operation, makes for efficient, low cost production. Shaper sizes 12" to 32" are fully described in S & M's latest catalog—yours for the asking.

THE SMITH & MILLS CO.

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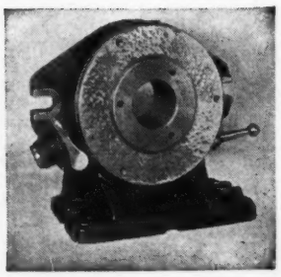

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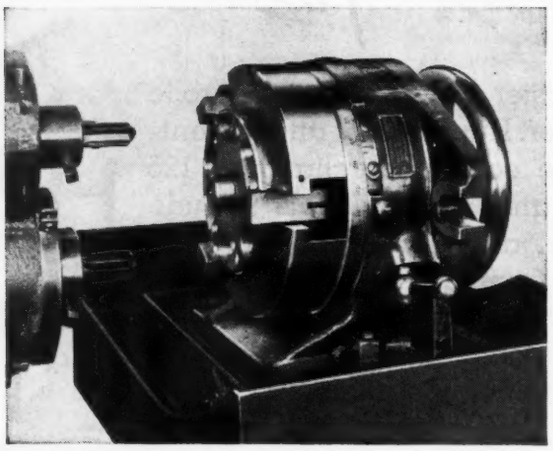

THE HARTFORD SUPER-SPACER

Use the Hartford Super-Spacer Base as the foundation; add special fixtures to meet your own requirements. Shown above, for example, is a Super-Spacer base mounted with a special fixture for speeding a close-tolerance milling operation. Using a 6-notch index plate, three pairs of slots are milled in an aircraft engine part.

Ruggedly built, accurate in operation, the Hartford Super-Spacer is quickly set up, quickly changed from horizontal to vertical operation. Interchangeable mask plates make divisions of 2, 3, 4, 6, 8, 12 and 24 —without counting off . . . without any possibility of error.

Write for illustrated bulletin showing how the Super-Spacer can be used for milling, drilling, grinding, jig boring, planing and other operations.

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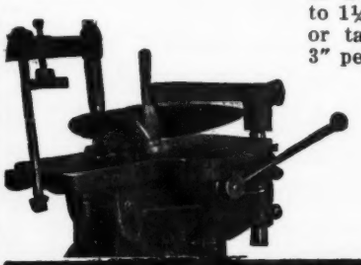
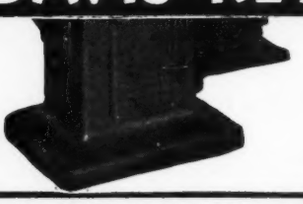
PUT KEYSEATING IN THE PRODUCTION CLASS!

The Davis multiple tooth broaching pull cut, and the ease and speed with which even taper bores can be set up, put keyseating the Davis way into the class with high production operations. One machine and the necessary Davis cutters will cut all keyways up to 14" long, from 1/16" to 1¼" in width, straight or tapering as much as 3" per foot.



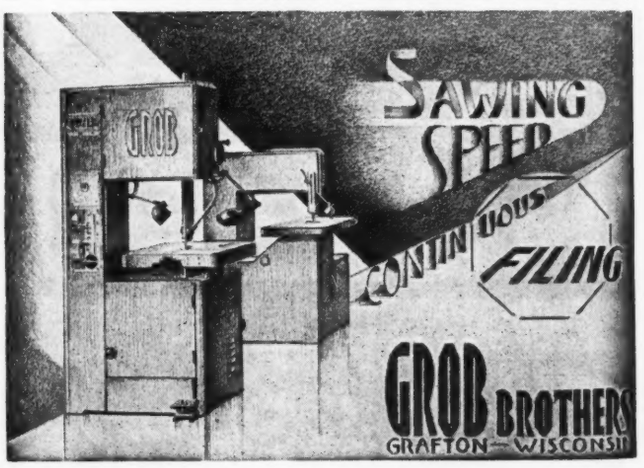
Write for bulletin giving complete specifications.

DAVIS KEYSEATERS



Shown: The tilting table model. Cuts straight keyways or keyways tapering as much as 3" per foot.

DAVIS KEYSEATER COMPANY
405 Exchange St. ROCHESTER, N. Y.



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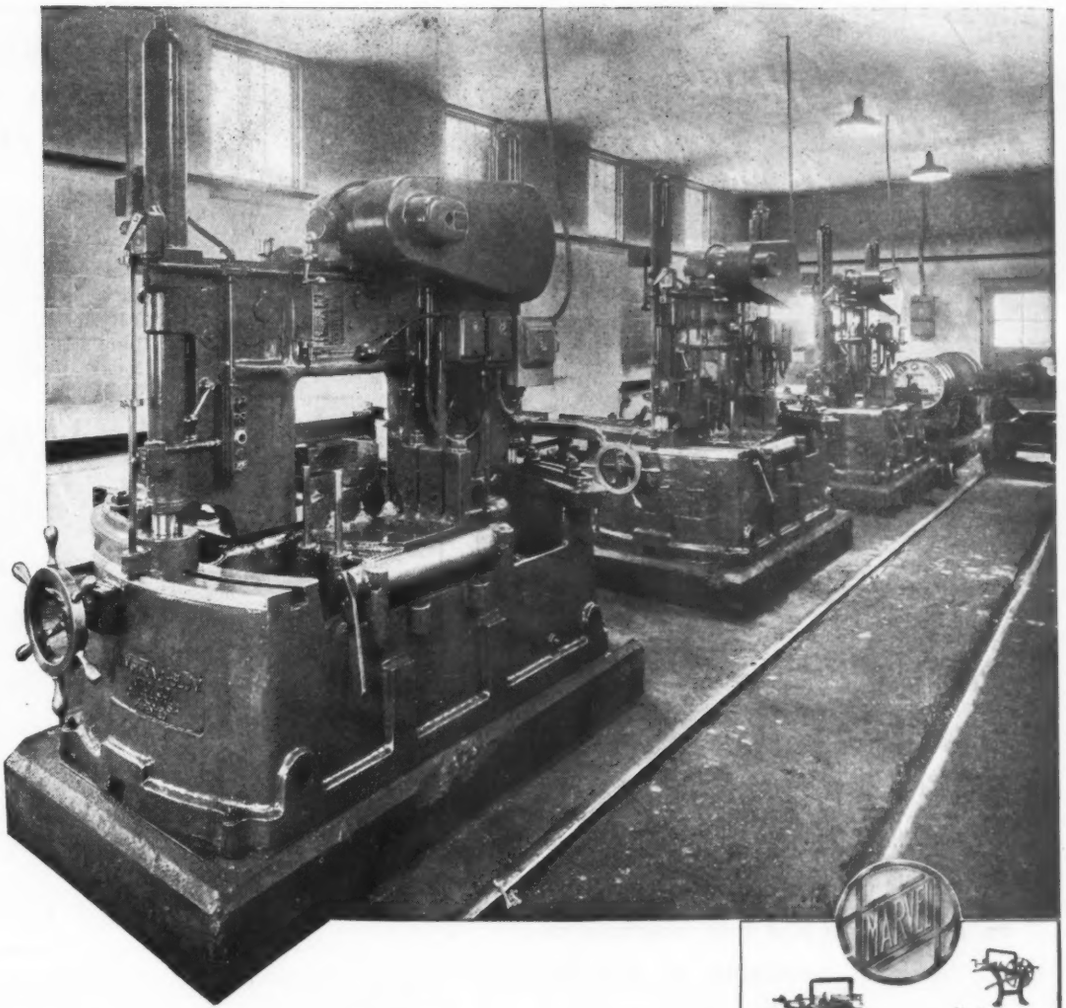
Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

Huther Bros. Saw Mfg. Co.
ROCHESTER NEW YORK



EASILY CUT-OFF TOUGHEST STEELS

Steels just don't come too tough for MARVEL Giant Hydraulic Hack Saws. Take, for example, the three No. 18 MARVEL Saws, at the Babcock & Wilcox steel mill, shown above. These machines are used to cut test specimens from sample pieces of stainless and other tough alloy billets which are checked for seams, pipes, etc., before being drawn into tubing. It takes tough steel to make the best tubing, and it takes modern sawing equipment to cut it rapidly, accurately and economically.

With 10 types of metal-cutting saws, each available in a series of variations, MARVEL can furnish sawing machines that exactly meet your requirements. If you have a metal-sawing problem—call in the local MARVEL Sawing Engineer.

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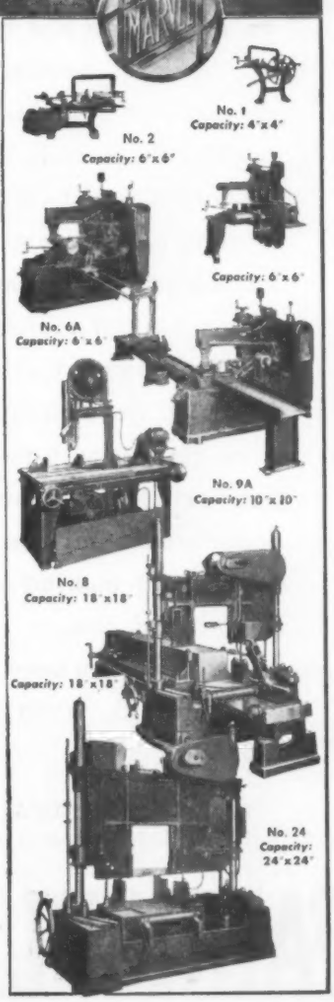
ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE CHICAGO 39, U.S.A.

Eastern Sales Office: 225 LAFAYETTE ST., NEW YORK 12, N. Y.



MARVEL SAWS

FAIRFIELD'S production of many thousands of differentials for heavy duty trucks is just one example of the facilities available to you for production of gears, differentials, splined shafts and allied items.

Every job that comes to Fairfield is done on the very best machines for fast production and is done by highly skilled craftsmen who give the task expert attention. Well-equipped gear cutting departments work closely with the grinding department, the automatic turning department, and the heat treating department, making production fast, smooth and sure.

Next time you need gears, remember Fairfield. Write for illustrated brochure.

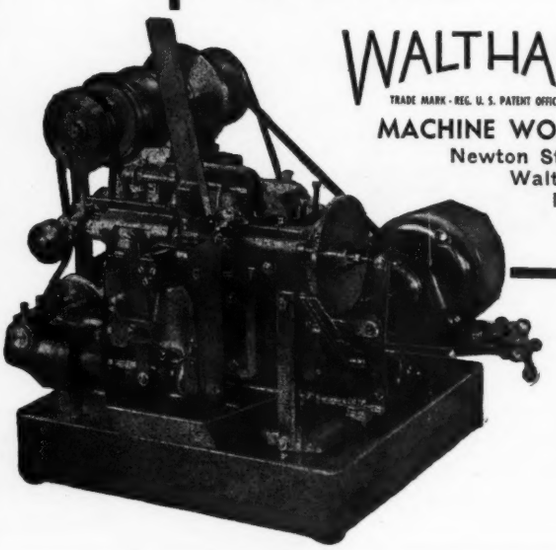
FAIRFIELD MANUFACTURING CO.
309 S. Earl Avenue • Lafayette, Ind.

FAIRFIELD for FINE GEARS

GEAR AND PINION CUTTERS by WALTHAM

HIGH ACCURACY ON FINE PITCH JOBS

Here's a compact, high production machine that will produce accurate results on small jobs. Individually driven, cam-controlled workslide and automatic loading and unloading eliminate lost motion. Write for full details of this and other Waltham machines for accurate small part production.



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TRADE MARK - REG. U. S. PATENT OFFICE
MACHINE WORKS
Newton Street,
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GEARS OF ALL TYPES and MATERIAL—UP TO 36"
MADE *Exactly* TO YOUR SPECIFICATIONS

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Ohio Stock Gears and Reducers

PUT "OHIO STOCK"

ON THE SPECIFICATIONS TO SAVE POWER TRANSMISSION DOLLARS

Three big advantages, every one a saving, come when you specify Ohio Stock Gears or Speed Reducers for the drives of your machines:

1. They **are** stock, cutting the extra cost of special orders.
2. Normally deliveries are quicker saving the cost of long waits and delays.
3. Replacements are quicker, cost less and save expensive down-time.

Ohio Stock Gears are available in spur, helical, bevel, worm and worm gear types, in pitch diameters from 24 to 6 and in mitre type from 24 to 4.

Ohio Stock Reducers include ratios from 10-1 to 3200-1; single reduction capacities from 10 HP to 1/6 HP; double reduction capacities from 6000 inch pounds to 25 inch pounds.

Put these Ohio Stock Gear and Speed Reducer advantages to work on the machines you design and operate. Our nearest representative will be glad to help you.

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1331 EAST 179th ST. • CLEVELAND 10, OHIO

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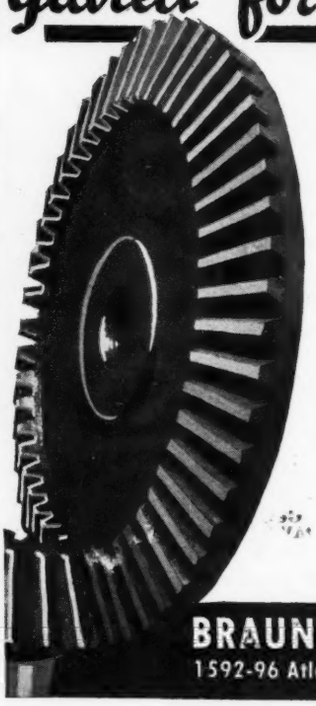

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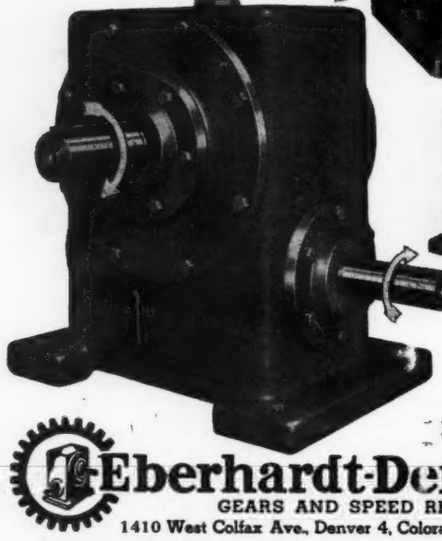

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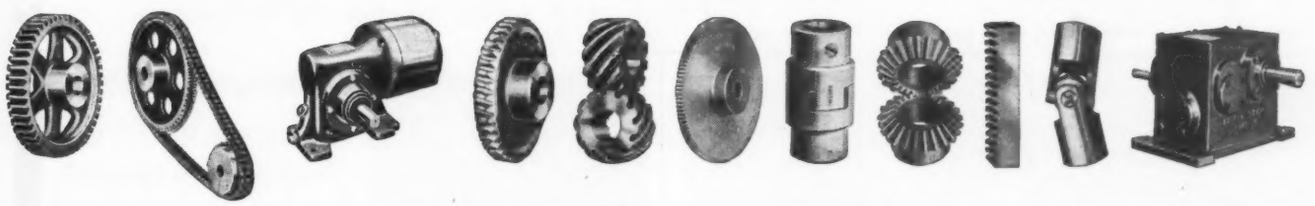

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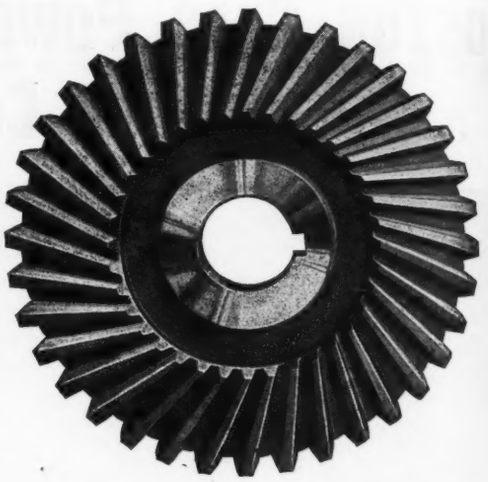

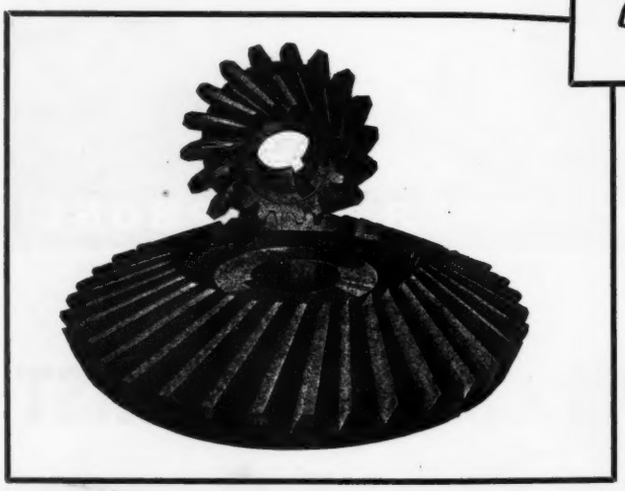

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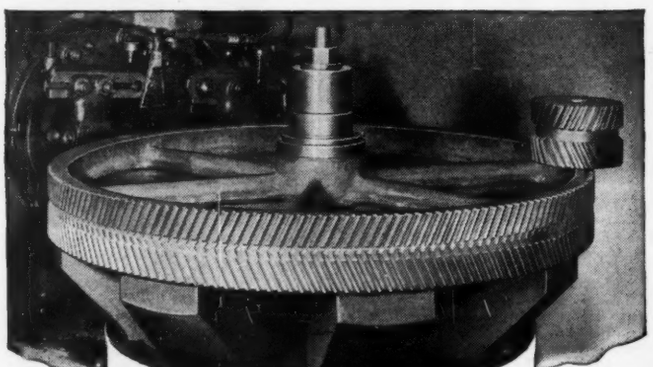

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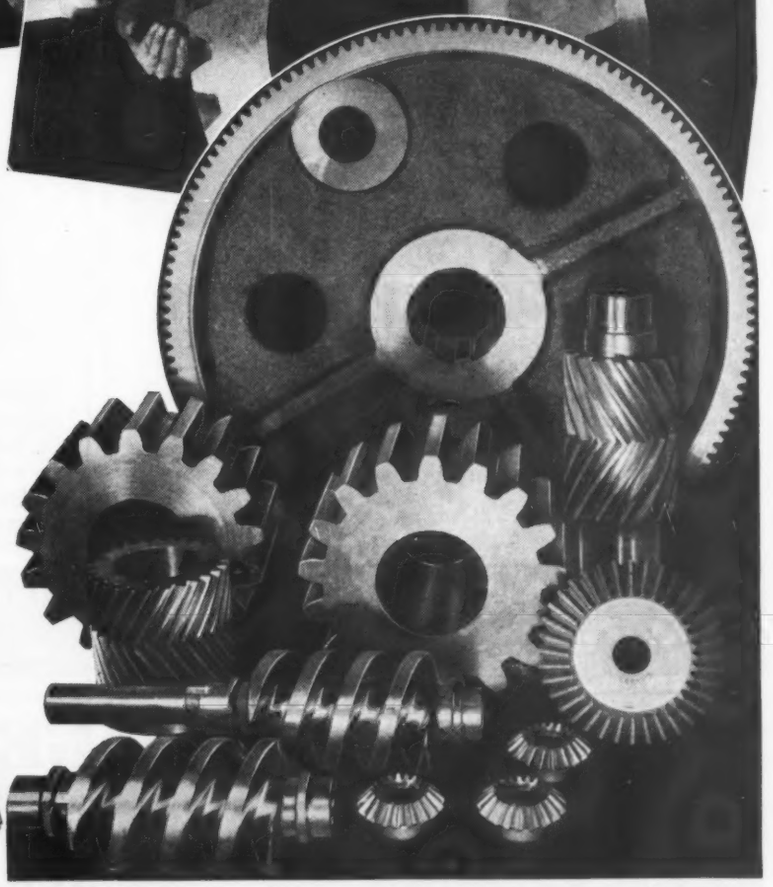

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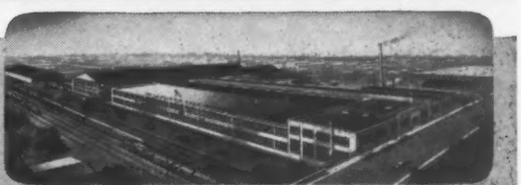

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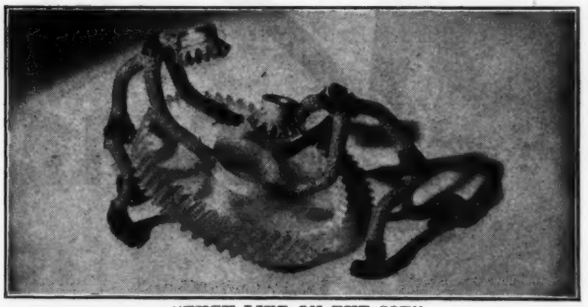

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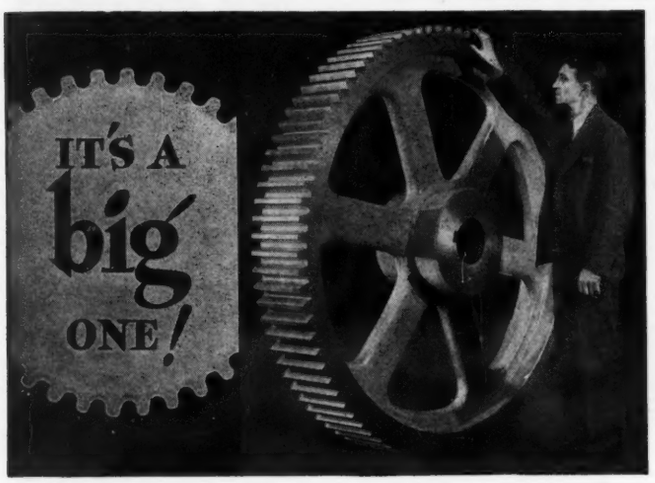

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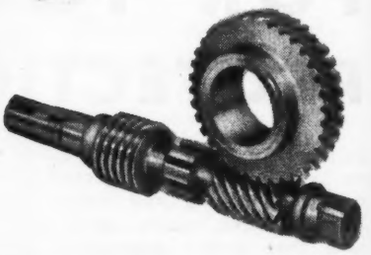

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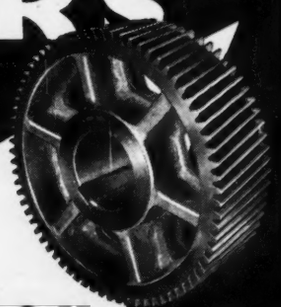

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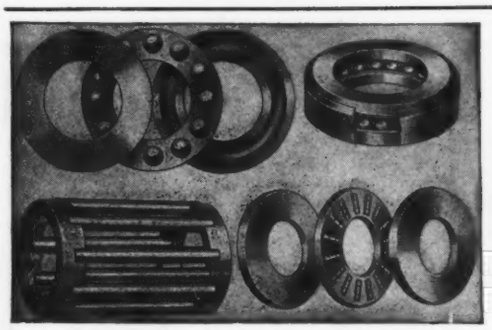

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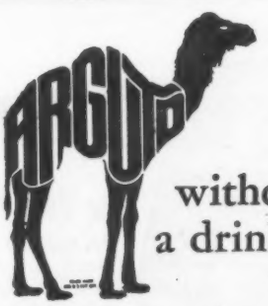

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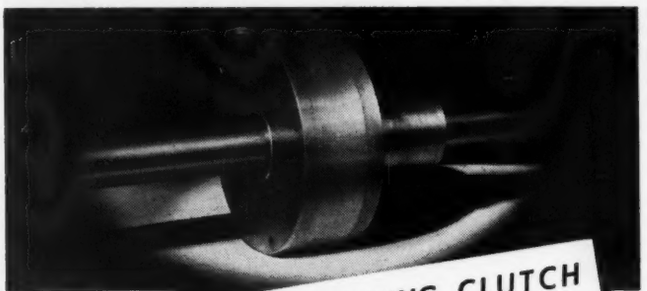

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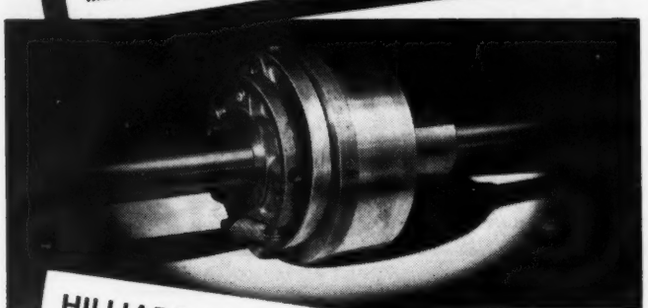

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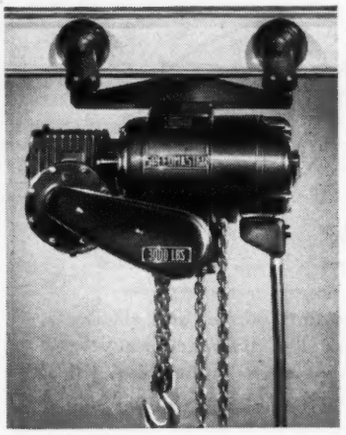

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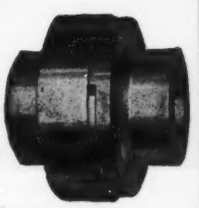

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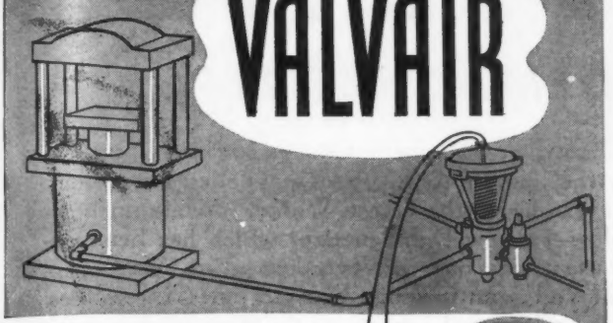
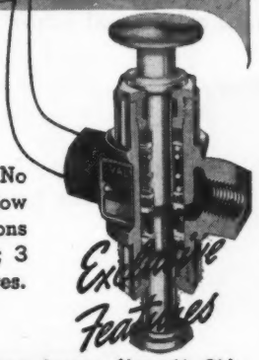


Diagram shows press operated by 2-pressure hydraulic valve with automatic H. P. inlet valve. Hydraulic valve controlled by Valvair knob-operated valve.



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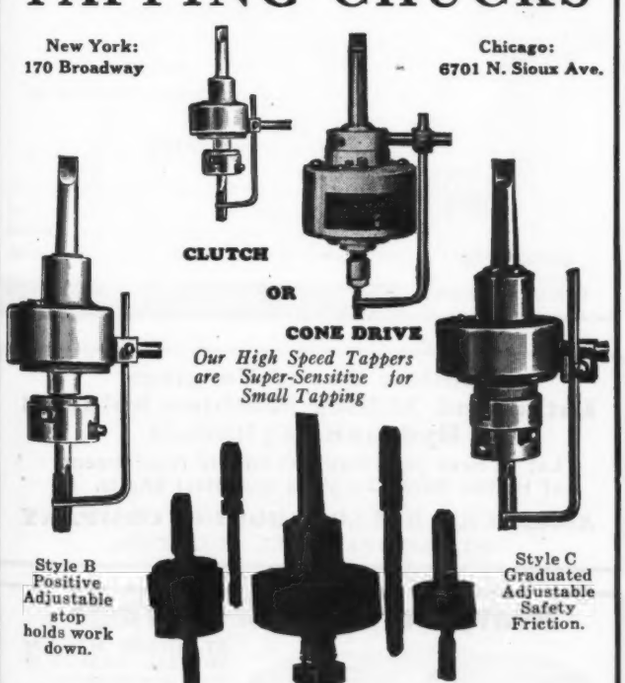

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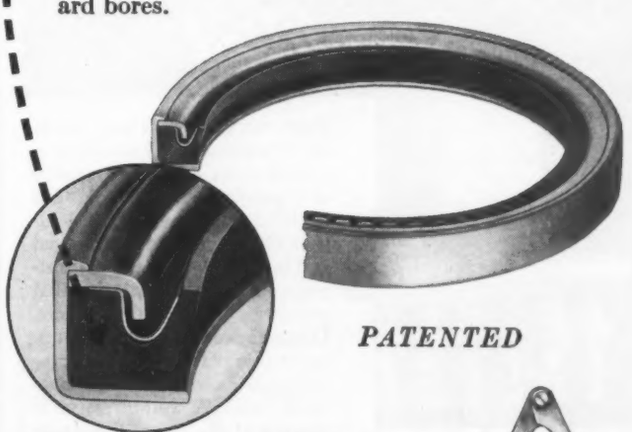

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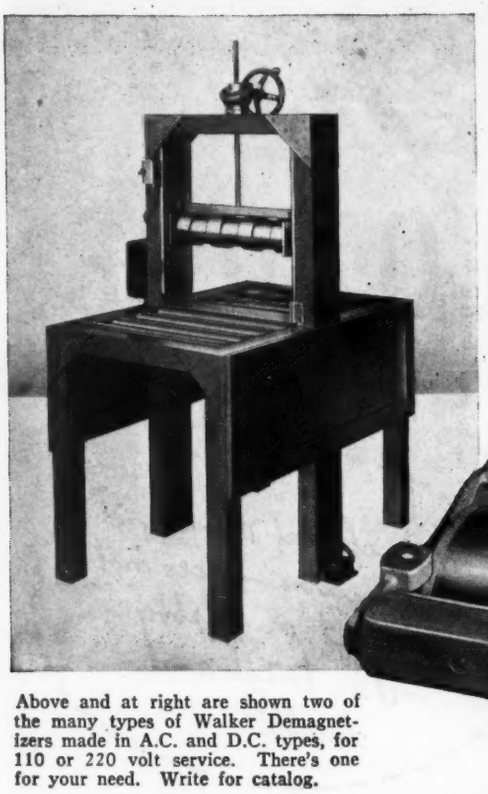

Above and at right are shown two of the many types of Walker Demagnetizers made in A.C. and D.C. types, for 110 or 220 volt service. There's one for your need. Write for catalog.

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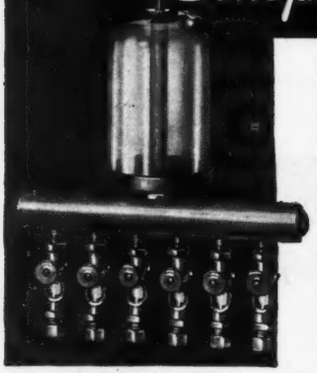

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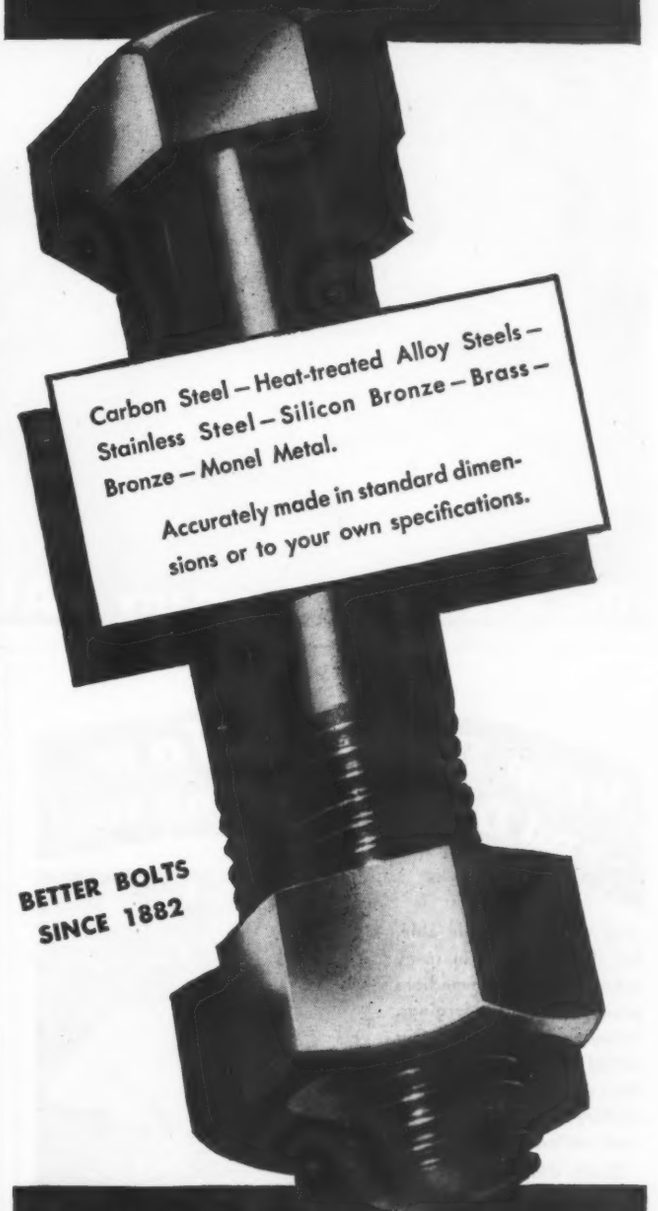

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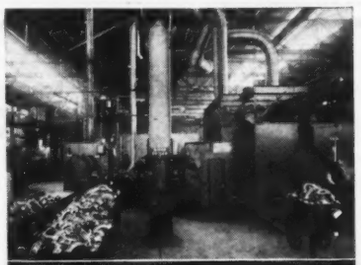

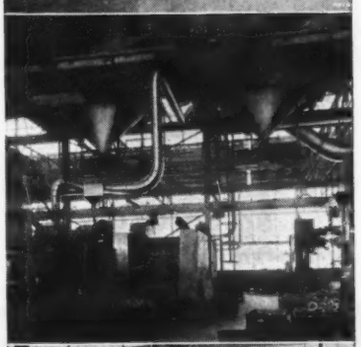

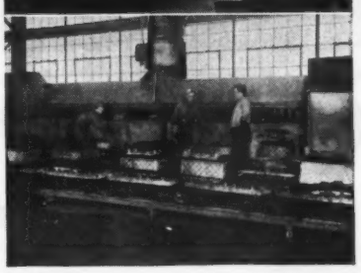

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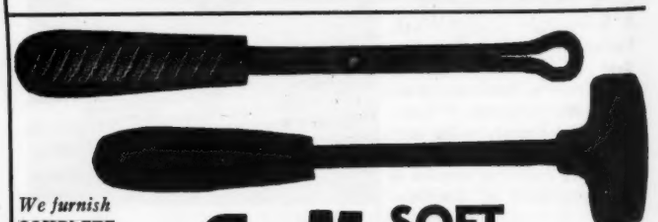

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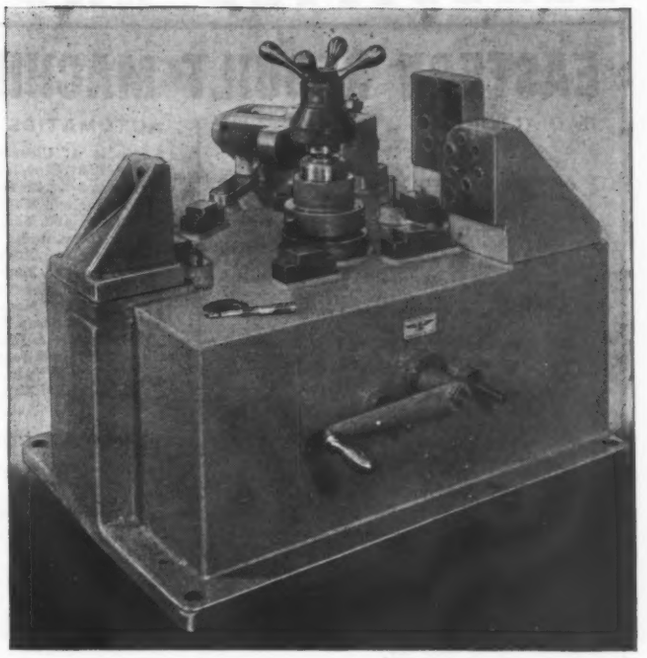

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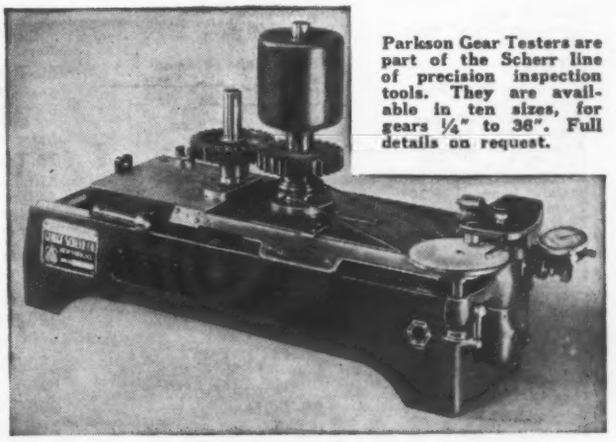

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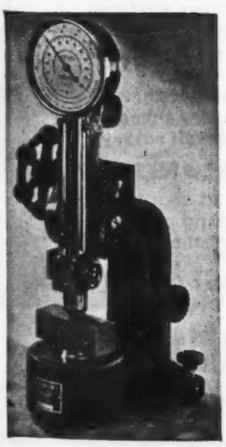

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No. 2 Brown & Sharpe universal.
No. 104 Rivett internal.
No. 72A3 Heald Sizematic internal.
No. 75A Heald, cross feed head.
20", No. 120A Gardner opposed disc.
No. 2 Cincinnati centerless.
12"x36", 16"x36" & 16"x72" Landis.
10"x18", 10"x36" & 10"x50" Norton.
6"x18" B. & S. elec. hydraulic.
6"x18" Cincinnati, hydraulic.
6"x18" Norton hydraulic.
6"x18" Landis hydraulic.

HAMMERS
2000 lb. Chambersburg board drop.
2000 lb. & 3000 lb. Billings & Spencer board drop.

LATHES
36"x18' Bridgeford geared hd.
14"x6' & 16"x6' American, grd. hd.
14"x6' Hendey grd. hd. toolroom.
17"x6' Leblond grd. hd. Mfg.
14"x18" Monarch Magnamatic.
14"x19" Fay automatic.
15"x22½" Sundstrand auto. stub.
8" and 12" Sundstrand stub.

MILLERS
Nos. 2B & 3B Milwaukee plain.
No. 35 Ohio universal.
No. 2 Brown & Sharpe vertical.
No. 2½B Milwaukee vertical.
No. 4—36 Cincinnati Hydromatic.
30" & 48" Newton rotary.
No. CT36 Lees Bradner thread.
Type C Hall planetary thread.
30", 42" & 84" Ingersoll rotary.

SHAPERS & PLANERS
32" Morton draw cut shaper.
30"x30"x12' Cleveland openside.
32"x32"x8' Cincinnati planer.

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Miles Machinery Co.

Saginaw, Mich.

SIMMONS CURRENT ATTRACTIONS

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24" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

42" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

72" CINCINNATI, 2 swivel heads, all geared feeds.

84" CINCINNATI Vertical, 1-swivel head, 1-turret head, all geared feeds, motor drive.

100" N-B-P, 2 swivel heads, all geared feeds, M.D.

14-20' NILES-BEMENT-POND heavy extension type, all geared feeds, M.D.

3" Bar Universal TRI-WAY horizontal table type boring, 32"x58" table.

4½" Bar NILES - BEMENT - POND Horizontal table type boring, drilling and milling machine, all geared feeds, AC or DC drive.

No. 1 4" Bar DETRICK and HARVEY floor type horizontal boring, drilling and milling machine. AC or DC.

5½" Bar NILES - BEMENT - POND Heavy floor Type Horizontal Boring, Drilling, Milling Machine, AC or DC motor drive.

9" Bar BETTS Floor type. 8' Vertical travel, 8' Horizontal, Modern Machine, 4-Motors.

JIG BORER

NO. 2 PRATT & WHITNEY Jig Boring Machine, with 22" x 44" table, self-contained, motor drive.

DRILLS

4' AMERICAN plain triple purpose enclosed head drill with tapping.

5½' AMERICAN Full Universal Triple Geared with tapping attachment. Single pulley belt drive or AC or DC motor drive.

NO. 310 BAKER High Speed

NO. 314 BAKER High Speed.

GEAR HOBBER

100" GOULD-EBERHARDT Horizontal for spur, helical and worm gear. Maximum capacity 101" diameter, 48" face. Forced feed lubrication.

NO. 18-H GOULD-EBERHARDT, M.D.

GRINDERS

NO. 70 HEALD Internal M.D.

NO. 2 CINCINNATI Centerless.

NO. 2 CINCINNATI Universal Cylindrical.

24"x20' Centers NORTON plain, Cylindrical, individual motor drive to work spindle, wheel spindle and table.

TURRET LATHES

NO. 3AL GISHOLT with hardened steel ways.

26"x10' LIBBY with 7½" hole through spindle. Power rapid traverse.

LATHES

20"x8' AMERICAN geared head, M.D.

24"x10' AMERICAN geared head, M.D.

30"x14' LODGE-SHIPLEY, G.H.

36"x20' LODGE-SHIPLEY, G.H.

36"x20' AMERICAN, 16-Speed Geared Head.

NO. 3 NILES - BEMENT - POND Axle Lathe.

30"x34' LEBLOND Boring Lathe, geared heads, quick change gear.

48"x30' BRIDGEFORD 9 Speed Geared Head, 20' between centers. Triple geared internal face plate drive. AC or DC motor.

48"x59' BRIDGEFORD Boring and Turning with 9 speed geared headstock, turning carriage with compound rest, AC or DC motor drive.

79" NILES-BEMENT-POND Locomotive Driving Wheel Lathe, Journal turning attachment.

42" PUTNAM Carwheel Lathe, M.D.

MILLERS

NO. 2B and 3B MILWAUKEE Plain, double overarm.

NOS. 2 and 3 CINCINNATI High Power, Vertical.

NO. 4 CINCINNATI High Power Plain, Power rapid traverse, table 16½"x64". Single pulley, belt drive or AC or DC.

NO. 4 CINCINNATI High Power Vertical. Power rapid traverse. Table 16½"x64". Single pulley belt drive.

NO. 5 CINCINNATI Plain, rectangular overarm.

24"x24"x12' INGERSOLL Planer Type milling machine with one head on adjustable rail and two side heads.

42"x26"x12' INGERSOLL Planer Type milling machine with two heads on adjustable rail and two side heads AC, DC.

PLANERS

48"x48"x15' NILES - BEMENT - POND Heavy with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

48"x48"x24' NILES - BEMENT - POND Heavy with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

48"x48"x32' G. A. GRAY Spiral Drive with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

60"x60"x20' N-B-P heavy, 2-rail heads, 2-side heads, 230 Volt, DC reversing planer motor and control.

72"x72"x15' N-B-P, 4 heads, double deck, 230 Volt, DC.

72" x 60" x 30' HAMILTON, 2 heads, operating condition as inspected F.O.B. CARS ALABAMA.

120"x96"x20' CINCINNATI, Rapid traverse, 4-Heads, 230 Volt DC, Reversing type Planer Motor and Control.

84"x60"x20' DETRICK-HARVEY open-side with auxiliary housing, 230 Volt, DC.

SLOTTERS

6" & 10" PRATT & WHITNEY vertical Shaper with rotary table, power feeds, tilting ram, AC or DC.

16" SPRINGFIELD Shaper, M.D.

15" NEWTON Crank slotter, 30" circular table, AC or DC.

15" NILES-BEMENT-POND, 30" circular table, AC or DC motor drive through gear box.

21" N-B-P Slotter, 44" Rotary table.

MISCELLANEOUS

60" NEWTON cold saw, M.D.

30' NO. 3 HILLES JONES Plate Edge Planer.

30'x¼" NILES-BEMENT-POND Plate Bending Rolls, pyramid type.

1½" ACME Class "A" Bolt Cutter.

NO. 55 NEWARK Spur Gear Cutter.

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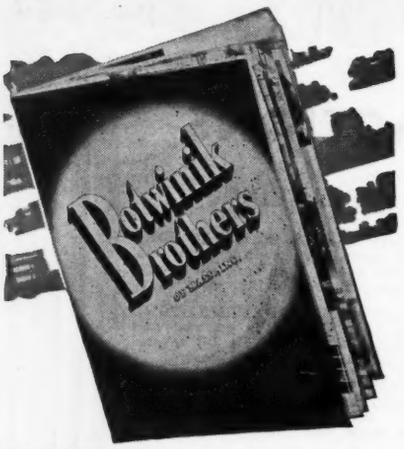

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3—Amer. 24" x 12'; (2) Timk. bear. Eng. Lathes, M.D., 24" x 10'; (1) 12 speed, grd. hd., pan bed, Eng. Lathe, M.D., very latest type, sw. over bed 27½", dist. bet. ctrs. 72" and 48".

1—Bridgeford 36" x 56', 15 speed, grd. hd., Eng. Lathe, M.D., AC elec. equip., power rap. trav. to carr., compound rest, 2 steady-rests, sw. over bed 38", sw. over carr. 26", dist. bet. cts. 48', 16 spin., taper att., mtzd. apron, completely rebuilt in 1943.

3—L. & S. 16" x 6', 16" x 8', 20" x 8', 12 speed, selec. grd. hd., Eng. Lathes, M.D.

P. & W 16" x 36" and 20" x 48" ctrs., Mod. B, grd. hd., motor in base, Eng. Lathes, sw. over beds 16½" and 21¼".

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1—Hendey 20" Stand. Crank Shaper, M.D., AC elec. equip., power down feed to hd.
2—Hendey 24" Heavy Duty Crank Shapers, M.D., very latest type, AC elec. equip.
1—Stockbridge 16" Crank Shaper, M.D.
1—Gleason 3" Gear Generator, M.D.

MILLERS

1—B. & S. No. 1A Univ. Miller, M.D., dbl. overarm type, AC motor in base, Timk. bear. spin., Ser. No. over 2960, tbl. wkg. surf, 11¼" x 46¾", range: long. 22", cross 8", vert. 18".

1—Milwaukee Mod. 2K Pl. Miller, M.D., Ser. No. over 18/3590, dbl. overarm type, AC motor in base, very latest type, tbl. wkg. surf. 56" x 12", range: long. 28", cross 10", vert. 17".

1—Milwaukee Mod. 2H Pl. Mill. Machine, very latest type, dbl. overarm, Timk. bear. spin., motor in base, tbl. wkg. surf. 50" x 10", range: long. 28", cross 10", vert. 17".

PLANERS

1—Wood & Powell, 24" x 24" x 6', sm. hd. on cross rail, M.D., with dbl. housing.

1—Cin. 42" x 42" x 12' Dbl. Housing Planer, M.D., 4 hds. on cross rail.

1—Cin. 48" x 48" x 20' Planer, M.D., AC variable drive, 2 hds. on cross rail, 1 side hd., AC motor and controls.

1—Cin. 72" x 56" x 20' Dbl. Hous. Planer, M.D., AC elec. equip., 2 rail hds, 2 side hds., rap. trav. to all hds., forced feed lub., herringbone gear drive.

MISCELLANEOUS

2—Landis 1½" "Landmaco" Leadscrew Type Bolt Threaders, very latest type, cap. 1½" dia., max. trav. carr. 13½", AC elec. equip., stand. rotary die hds, some chasers

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No. 3 Adams Farwell Gear Hobbing Machine.
No. 6—60" Brown & Sharpe Gear Cutter.
6" Bilgram Bevel Gear Generator.

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Lees-Bradner Gear Grinder.
10"x96" Landis Plain Self Contained.
12"x36" Cincinnati Universal Hydraulic.

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No. 4 Cincinnati Dial Type Medium Speed, A.C., M.D.
No. 2B Milwaukee Plain, S.P.D.

RADIAL DRILLS

6' American Triple Purpose, M.D.
3' Cincinnati-Bickford, S.P.D.
6' Cincinnati-Bickford, M.D.
7' Cincinnati-Bickford, M.D.

MISCELLANEOUS

36" Bullard New Era Vertical Turret Lathe.
24"x24"x10' Powell Planer, 2 Hds, M.D.
42" Bullard, 2 Heads, Self-contained type.
No. 3 Warner & Swasey Universal, A.C.M.D.
No. 4A Warner & Swasey Univ. Hollow Hex. 9" hollow spindle, A.C.M.D. Chuck & Bar feed
No. 4A Warner & Swasey Univ. Hollow Hex. Turret Lathe, 12" hollow spindle—A.C.M.D. —latest type.

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1 Model 4 U Serial No. 629373 W

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With Selective Gear Box.

Never used on heavy work. Completely equipped with wide range of attachments including bar feed and chuck. Additional information upon request. Nolde and Horst Company, Reading, Pa.

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Carborundum Co.
Walls Sales Corp.

ABRASIVE DISCS
See Discs, Abrasive.

ABRASIVES, POLISHING
Carborundum Co.
Norton Co.

ACCUMULATORS, Hydraulic
Baldwin-Southwark Corp.
Bethlehem Steel Co.
Elmes Engineering Works
Farquhar, A. B., Co.
Farrel-Birmingham Co., Inc.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.
Watson-Stillman Co.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOYS FOR DIES
National Lead Co.

ALLOY-STEELS
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carnegie-Illinois Steel Corp., (U. S. Steel Corp. Div.)
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel Co.
Frasse, Peter A., & Co., Inc.
Republic Steel Corp., (Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

ALLOYS, ALUMINUM
Aluminum Co. of America

ALLOYS, MAGNESIUM
Dow Chemical Co.

ALLOYS, NON-FERROUS
American Brass Co.

ARBOR PRESSES
See Presses, Arbor.

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Hannifin Mfg. Co.
Jacobs Mfg. Co.
Kempsmith Mch. Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

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Besly, Chas. H., & Co.
Bunting Brass & Bronze Co.
Cramp Brass & Iron Fdrs. Div.
Johnson Bronze Co.
Ryerson, Joseph T., & Son, Inc.

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Gisholt Machine Co.
Ideal Industries, Inc.
Norton Co.
Pope Machinery Corp.
Sundstrand Mch. Tool Co.
Taylor Mfg. Co.

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Gwilliam Co.
S K F Industries, Inc.

BARS, Boring
See Boring Bars.

Phosphor Bronze
Bunting Brass & Bronze Co.
Johnson Bronze Co.

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Frasse, Peter A., & Co., Inc.
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Timken Roller Bearing Co.
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Mahon, R. C., Co.

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Ball & Roller Bearing Co.
Bantam Bearings Div.
Bearings Co. of America
Boston Gear Works, Inc.
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Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

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Modern Tool Works
National Machinery Co.
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Bethlehem Steel Co.
Elastic Stop Nut Corp. of America
National Acme Co.
Pawtucket Mfg. Co.
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Industrial Press
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Barnes Drill Co.
Barnes, W. F., & John, Co.
Bullard Company
Consolidated Mch. Tool Corp.
Cosa Corp.
Foote-Burt Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Jones Machine Tool Wks., Inc.
Moline Tool Co.
National Acme Co.
National Automatic Tool Co.
Pedrick Tool & Mch. Co.
Rogers Machine Works, Inc.
Sellers, Wm., & Co., Inc.

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Cincinnati Planer Co.
Cosa Corp.
Jones Machine Tool Works, Inc.
Rogers Machine Works, Inc.
Sellers, Wm., & Co., Inc.

BORING BARS
Armstrong Bros. Tool Co.
Bullard Company
Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel Co.
Gairing Tool Co.
Gisholt Machine Co.
McCrosky Tool Corp.

TAPPING TIPS*

From Woody Spencer's Notebook

Boy, Can You Get Cockeyed Threads With A Set Screw!

Best way I've seen for getting oversize cuts and cockeyed threads is to use a set screw to lock the tap shank to the spindle. Even a little extra pressure on the screw is almost sure to cock the tap a little out of line. You know the result; bell mouth, oversize holes, rough, torn threads. Usually winds up too, with a broken tap. There's nothing like a tight, rigid holder and a little foresight in seeing that holder, tap and hole all line up true. Pays off too, in faster, easier work and fewer rejects.

We don't want you to take these Tapping Tips of Woody's as engineering advice, designed to solve tapping problems. They are merely handy hints, bits of information and short cuts that the boys in some shop have found out and they are being passed on by Woody for whatever they're worth in saving time, making some routine job run easier, maybe cutting down on rejections.

For the individual problems that come up so frequently, we suggest definite engineering advice. Send us complete data on the job,—kind of material, diameter and depth of hole, whether it is blind or through, what kind of lubricant used and any other information regarding the job. Our engineers will be glad to make recommendations covering the job without obligations, of course.

You'll find a copy of Woody Spencer's Handy Tap Guide a mighty useful mine of tap information, all arranged and indexed for quick, easy use. It's FREE. Write for your copy on your company letterhead.

*NOTE: Woody Spencer's Tapping Tips will appear here as often as Woody gets time to write them up. Look for them.

THE RIGHT TAP AT THE RIGHT TIME

The Wood & Spencer Company
Cleveland 3, Ohio

Ready Tool Co.
Scully-Jones & Co.
Warner & Swasey Co.
Williams, J. H., & Co.

BORING, DRILLING AND MILLING MACHINES, Horizontal

Barnes, W. F., & John, Co.
Cross Co.
Firth-Sterling Steel Co.
Giddings & Lewis Mch. Tool Co.
Ingersoll Milling Mch. Co.
Jones Machine Tool Wks., Inc.
Lucas Mch. Tool Co.
Moline Tool Co.
National Automatic Tool Co.
Ohio Machine Tool Co.
Sellers, Wm., & Co., Inc.
Sommer & Adams Co.
Universal Boring Machine Co.

BORING HEADS

Criterion Machine Works
Ex-Cell-O Corp.
Gairing Tool Co.
McCrosky Tool Corp.

BORING HEADS, Offset

Gairing Tool Co.

BORING MACHINES, Diamond and Carbide Tool

Ex-Cell-O Corp.
Heald Machine Co.
National Automatic Tool Co.
Stokerunit Corp.

BORING MACHINES, Jig

Cincinnati Bickford Tool Co.
Fosdick Machine Tool Co.
Kearney & Trecker Products Corp.
Machinery Mfg. Co.
Moore Special Tool Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.
Triplex Machine Tool Corp.

BORING TOOLS

Armstrong Brothers Tool Co.
Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel Co.
Gairing Tool Co.
Gisholt Mch. Co.
Haynes Stellite Co.
Jones & Lamson Mch. Co.
Kennametal, Inc.
McCrosky Tool Corp.
Morse Twist Drill & Mch. Co.
Ready Tool Co.
Scully-Jones & Co.
Slocomb, J. T., Co.
Union Twist Drill Co.
Warner & Swasey Co.
Williams, J. H., & Co.

BRAKES, Press and Bending

Bliss, E. W., Co.
Cincinnati Shaper Co.
O'Neil-Irwin Mfg. Co.
Peck, Stow & Wilcox Co.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Verson Allsteel Press Co.
Warren City Mfg. Co.
Watson-Stillman Co.

BROACHES

American Broach & Mch. Co.
Carboloy Co., Inc.
Detroit Broach Co.
Ex-Cell-O Corp.
Illinois Tool Wks.
Lapointe Machine Tool Co.
National Broach & Mch. Co.

BROACHING MACHINES

American Broach & Mch. Co.
Cincinnati Milling Mch. Co.
Consolidated Mch. Tool Corp.
Foote-Burt Co.
Lapointe Machine Tool Co.
National Broach & Mch. Co.
Oilgear Co.

BRONZE

American Brass Co.
Ampco Metal, Inc.
Bunting Brass & Bronze Co.
Cramp Brass & Iron Foundries Div.
Delta Manufacturing Co.
Jefferson Machine Tool Co.
Johnson Bronze Co.
Shook Bronze Co.

BUFFERS

Bridgeport Safety Emery Wheel Co., Inc.
Delta Manufacturing Co.
Gardner Machine Co.
Production Machine Co.
Rotor Tool Co.

BULLDOZERS

Ajax Manufacturing Co.
Baldwin-Southwark Corp.
Hannifin Mfg. Co.
Lake Erie Engineering Corp.
Watson-Stillman Co.

BURNISHING MACHINERY

Baird Machine Co.

BUSHINGS, Brass, Bronze, Etc.

Ampco Metal, Inc.
Boston Gear Works, Inc.
Bunting Brass & Bronze Co.
Haynes Stellite Co.
Johnson Bronze Co.

Hardened

Baumbach, E. A., Mfg. Co.
Danly Machine Specialties, Inc.
Leland-Gifford Co.
U. S. Steel Co., Inc.

Jig

Ampco Metal, Inc.
Ex-Cell-O Corp.
Universal Engineering Co.

CABINETS, Tool

Armstrong Brothers Tool Co.

CALIPERS

American Measuring Instruments Corp.
Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

CAM CUTTING MACHINES

Frew Machine Co.
Pratt & Whitney Co.

CAM MILLING AND GRINDING MACHINES

Rowbottom Machine Co.

CAMS

Hartford Special Mchry. Co.
Kux Machine Co.
Rowbottom Machine Co.
Vinco Corporation

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp.
Carboloy Co., Inc.
Firth-Sterling Steel Co.
Kennametal, Inc.
Metal Carbides Corp.
Vanadium Alloys Steel Co.

CASE-HARDENING

Pittsburgh Gear & Machine Co.
Williams, J. H., & Co.

CASE-HARDENING FURNACES

See Furnaces, Heat Treating.

CASTINGS

Aluminum, Brass, Bronze, Magnesium, Etc.

Aluminum Co. of America
Ampco Metal, Inc.
Bethlehem Steel Co.
(Brass and Bronze only)
Bunting Brass & Bronze Co.
Cramp Brass & Iron Foundries Div.
Permold Co.

Die

Aluminum Co. of America
American Brass Co.
Madison-Kipp Corporation
Veeder-Root, Inc.

Gray Iron

Bethlehem Steel Co.
Brown & Sharpe Mfg. Co.
Union Mfg. Co.

Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp.
American Brake Shoe Co.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Cramp Brass & Iron Foundries Div.
Lebanon Steel Foundry

CEMENT, Disc Grinding Wheel

Besly, Chas. H., & Co.
Carborundum Co.
Gardner Machine Co.
Hendey Machine Co.
Walls Sales Corp.

CENTERING MACHINES

Consolidated Mch. Tool Corp.
Cross Co.
Hanson-Whitney Machine Co.
Jones & Lamson Mch. Co.
Pratt & Whitney Co.

CENTERS

Lathe

Carboloy Co., Inc.

HEAT TREAT SMALL PARTS *In Your Own Plant*

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

More Profitable Reasons for Using Cooley Furnaces

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalized and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door—Counter weighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand—For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$146.00*
MH-4	10″W 6″H 18″L	.....	4800	20.9	$222.50*

*Includes Hearth Plate

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.
AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

COOLEY ELECTRIC MANUFACTURING CORP.
44 South Shelby Street Indianapolis 7, Indiana
INDIANAPOLIS MACHINERY EXPORT CORP.
Export Manager, 44 Whitehall Street, New York, New York

Firth-Sterling Steel Co.
Ideal Industries, Inc.
Kennametal, Inc.
Morse Twist Drill & Mch. Co.
Scully-Jones & Co.
Standard Tool Co.

Planer and Miller

Cincinnati Planer Co.

CHAIN DRIVES

Morse Chain Co.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, Inc.
Philadelphia Gear Works

CHAMFERING MACHINES, Gear Tooth

Bilgram Gear & Mch. Works
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Lipe-Rollway Corp.

CHARTS, MEASUREMENT

Capell Engrg. Co.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co.

CHUCKING MACHINES

Baird Machine Co.
Bardons & Oliver, Inc.
Bliss, E. W., Co.
Bullard Company
Cleveland Automatic Machine Co.
Gisholt Machine Co.
Goss & DeLeeuw Mch. Co.
Heald Machine Co.
Jones & Lamson Machine Co.
National Acme Co.
New Britain-Gridley Mch. Div.
Potter & Johnston Mch. Co.
Sundstrand Mch. Tool Co.
Warner & Swasey Co.

Multiple Spindle

Goss & DeLeeuw Mch. Co.
National Acme Co.
New Britain-Gridley Mch. Div.

CHUCKS

Air Operated

Hannifin Mfg. Co.
Logansport Machine Co., Inc.
Skinner Chuck Co.
Union Mfg. Co.

Collet or Split

See Collets.

Diaphragm

Van Norman Co.

Drill

Cleveland Twist Drill Co.
Ettco Tool Co.
Jacobs Mfg. Co.
McCrosky Tool Corp.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Procunier Safety Chuck Co.
Scully-Jones & Co.
Skinner Chuck Co.
Standard Tool Co.
Taylor Mfg. Co.
Union Mfg. Co.

Full Floating

Errington Mechanical Laboratory
Gisholt Mch. Co.
Scully-Jones & Co.

Lathe, Etc.

Bullard Company
Cushman Chuck Co.
Gisholt Mch. Co.
Jones & Lamson Mch. Co.
Rivett Lathe & Grinder, Inc.
Scherr, George, Co., Inc.
Skinner Chuck Co.
Union Mfg. Co.
Warner & Swasey Co.

Magnetic

Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Hanchett Mfg. Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

Quick Change and Safety

Errington Mechanical Laboratory
McCrosky Tool Corp.
Modern Tool Works
Procunier Safety Chuck Co.
Scully-Jones & Co.

Ring Wheel

Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.

Tapping

Barber-Colman Co.
Errington Mechanical Laboratory
Greenfield Tap & Die Corp.
Jacobs Mfg. Co.
McCrosky Tool Corp.
Procunier Safety Chuck Co.
Scully-Jones & Co.
Skinner Chuck Co.

CIRCUIT BREAKERS

General Electric Co.
Westinghouse Electric Corp.

CLAMPS

Armstrong Brothers Tool Co.
Baumbach, E. A., Mfg. Co.
Besly, Chas. H., & Co.
Brown & Sharpe Mfg. Co.
Danly Machine Specialties, Inc.
Mead Specialties Co.
Starrett, L. S., Co.
Williams, J. H., & Co.

To eliminate costly rejection losses

they switched to Ampco Metal and Ampco's specialized casting-and-fabrication procedure . . .

This water outlet manifold for use on a Diesel engine was originally cast in brass with the ordinary foundry procedure. When it was discovered that rejection losses, due to flaws, ran far too high, the job was turned over to Ampco, for production with Ampco Metal.

Ampco engineers decided that by casting the part in two sections and welding them together with Ampco-Trode Coated Aluminum Bronze Electrodes, rejection losses would be practically eliminated, and money saved.

30 years of specialized experience enables Ampco foundries to produce uniform castings and to maintain required composition limits. Six standard grades and several modifications are available . . . all of which resist wear, shock, impact, and corrosion. A nearby Ampco field engineer will be happy to explain their respective advantages and answer any questions you may have concerning physical properties. Bulletins are available — write for them.

Specialists in engineering, production, finishing of copper-base alloy parts.

AMPCO **Metal**
The Metal without an Equal

Ampco Field Offices In Principal Cities

Ampco Metal, Inc. Dept. M-7, Milwaukee 4, Wisconsin

A-35

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div.
Oakite Products, Inc.

CLUTCHES
Barnes Drill Co.
Clearing Mch. Corp.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Hilliard Corp.
Johnson, Carlyle, Machine Co.
Lipe-Rollway Corp.
Morse Chain Co.
Rockford Clutch Div.
Twin Disc Clutch Co.

COATINGS, PROTECTIVE
Bakelite Corp.
Bullard Co., Bullard-Dunn Process Div.

COLLARS, Safety
Standard Pressed Steel Co.

Spacings, Etc.
Scully-Jones & Co.

COLLETS
Ames, B. C., Co.
Brown & Sharpe Mfg. Co.
Cleveland Twist Drill Co.
Gisholt Mch. Co.
Hannifin Mfg. Co.
Hardinge Brothers, Inc.
Jones & Lamson Mch. Co.
Modern Tool Wks.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Scully-Jones & Co.
Standard Tool Co.
Stark Tool Co.
Union Twist Drill Co.
Universal Engineering Co.
Wade Tool Co.
Warner & Swasey Co.

COMPARATORS—
See Gages, Comparator.

COMPARATORS, Screw Thread
Jones & Lamson Mch. Co.
Scherr, George, Co., Inc.
Triplex Machine Tool Corp.

COMPOUNDS

Cleaning
Oakite Products, Inc.

Cutting, Grinding, Metal Drawing, Etc.
Cities Service Oil Co.
Gulf Oil Corp.
National Broach & Mch. Co. (Broaching and Lapping)
Oakite Products, Inc.
Shell Oil Co., Inc.
Standard Oil Co., (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.
United States Products Co. (Lapping)

Resin or Molding
Bakelite Corp.
Durez Plastics & Chemicals, Inc.
General Electric Co.

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DeLaval Steam Turbine Co.
Ingersoll-Rand Co.

CONTRACT WORK
Ace Manufacturing Corp.
American Measuring Instruments Corp.
Bliss, E. W., Co.
Columbus Die, Tool & Mch. Co.
Diefendorf Gear Corp.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Hill Acme Co.
Jack & Heintz Precision Industries, Inc.
Kaydon Engrg. Corp.
Langelier Mfg. Co.
LeBlond, R. K., Mch. Tool Co.
Mummert-Dixon Co.
National Acme Co.
Rockford Machine Tool Co.
Taft-Peirce Mfg. Co.
U. S. Tool Co., Inc.
Wade Tool Co.

CONTROLLERS
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Bristol Co.
Clark Controller Co.
General Electric Co.
Westinghouse Electric Corp.

COUNTERBORES
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Cleveland Twist Drill Co.
Continental Tool Works Div.
Ex-Cell-O Corporation
Firth-Sterling Steel Co.
Gairing Tool Co.
Genesee Tool Co.
Haynes Stellite Co.
Kennametal, Inc.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Starrett, L. S., Co.
Union Twist Drill Co.

COUNTERSHAFTS
LeBlond, R. K., Mch. Tool Co.
Standard Pressed Steel Co.
Warner & Swasey Co.

COUNTERSINKS
Ex-Cell-O Corp.
Gairing Tool Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

COUNTERS, Revolution
Bristol Co.
Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.
Veeder-Root, Inc.

COUNTING DEVICES
Starrett, L. S., Co.
Veeder-Root, Inc.

COUPLINGS

Flexible
Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Eberhardt-Denver Co.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Lovejoy Flexible Coupling Co.
Morse Chain Co.
Philadelphia Gear Works

Pipe, Tubes, Etc.
Dart, E. M., Mfg. Co.

Shaft
Boston Gear Works, Inc.
Foote Bros. Gear & Machine Corp.
Hilliard Corp.
Sellers, Wm., & Co., Inc.
Standard Pressed Steel Co.

CRANES, Electric Traveling
Morgan Engineering Co.
Shepard Niles Crane & Hoist Corp.

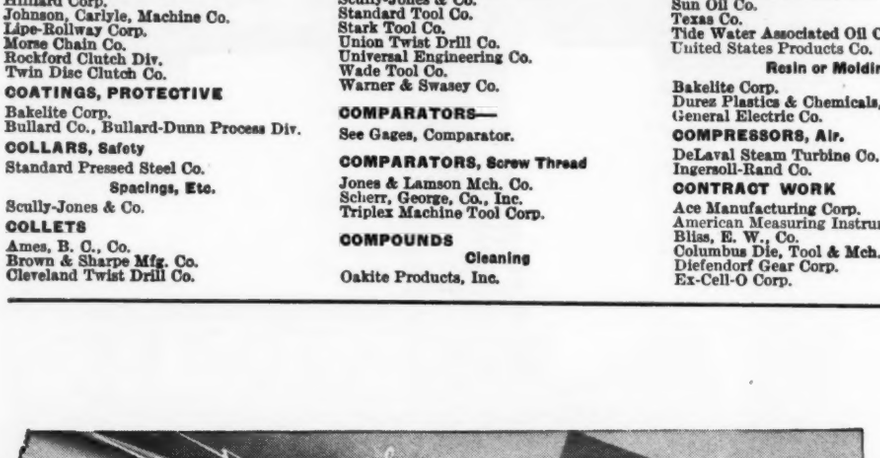
Hand Traveling
Shepard Niles Crane & Hoist Corp.

Locomotives
Cullen-Friestedt Co.
Hill Acme Co.

CUTTER GRINDERS
See Grinding Machines, Universal, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear
Brown & Sharpe Mfg. Co.
Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Illinois Tool Works
Michigan Tool Co.
Morse Twist Drill & Mch. Co.
National Broach & Mch. Co. (Gear Shaper)
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Waltham Mch. Wks.

Milling
Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Carboloy Co., Inc.
Columbus Die, Tool & Machine Co.
Continental Tool Works Div.
Detroit Tap & Tool Co.
Ex-Cell-O Corp.
Firth-Sterling Steel Co.
Gairing Tool Co.
Gammons-Hoaglund Co.
Genesee Tool Co.
Gorton, George, Mch. Co.
Haynes Stellite Co.
Illinois Tool Works
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kennametal, Inc.
McCrosky Tool Corp.
Modern Tool Wks.

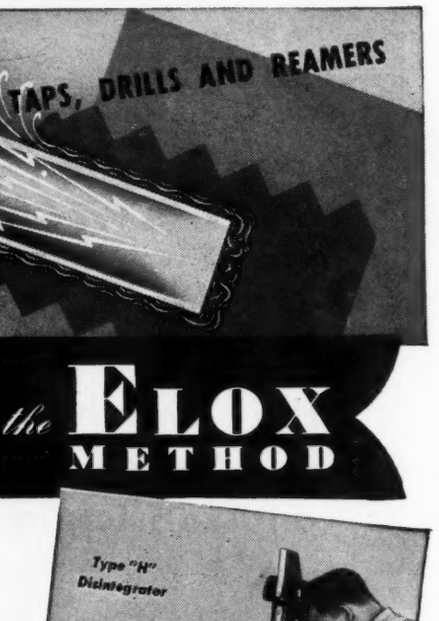


By the **ELOX METHOD**

The Elox method of removing a broken tool from a part being machined might very aptly be called "Disintegrator Drilling". It makes no difference how hard the broken tool may be. A core is drilled down through it by the Elox electrical disintegrator and the core removed. Then the remaining strips of thread of a tap or the cutting flutes of a drill or reamer are easily collapsed and picked out of the hole.

This method does not in any way damage the metal of the work part or the work already done on it. The temperature of the metal of the work part is not raised sufficiently to cause any metallurgical change.

The Elox method is also used to "drill" holes of various shapes in hardened dies and machine elements without annealing.



Write for Descriptive Folder and Specifications

CORPORATION **ELOX**

602 N. Rochester Road
Clawson • Michigan
Phone, Detroit: Elmhurst 6173

Covered by one or more of the following U. S. Patents: No. 2374348, No. 2383124, No. 2383382, No. 2383383. Other Patents Pending.

Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Producto Machine Co.
Reed-Prentice Corp.
Scully-Jones Co.
Standard Tool Co.
Union Twist Drill Co.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING-OFF MACHINES

Avey Drilling Machine Co.
Bardons & Oliver, Inc.
Bridgeport Safety Emery Wheel Co., Inc.
Brown & Sharpe Mfg. Co.
Consolidated Mch. Tool Corp.
Landis Machine Co.

Abrasive Wheel

Armstrong Brothers Tool Co.
Bridgeport Safety Emery Wheel Co., Inc.
Campbell, Andrew C., Div. American Chain & Cable Co., Inc.
Delta Manufacturing Co.

Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF TOOLS

Armstrong Brothers Tool Co.
Empire Tool Co.
Firth-Sterling Steel Co.
Haynes Stellite Co.
Illinois Tool Works
Luers, J. Milton
Pratt & Whitney Co.
Williams, J. H., & Co.

CUTTING-OFF WHEELS, Abrasive

Bay State Abrasive Co.
Carborundum Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

CYLINDER BORING MACHINES

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Barnes Drill Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ex-Cell-O Corp.
Ingersoll Milling Mch. Co.
Moline Tool Co.
Sellers, Wm., & Co., Inc.

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American Hollow Boring Co.
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Clearing Mch. Corp.
Denison-Engineering Co.
Galland-Henning Mfg. Co.
Hanna Engrg. Works
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Hydraulic Products Co.
Logansport Machine Co., Inc.
Oilgear Co.
Rockford Machine Tool Co.
Skinner Chuck Co.

Pneumatic

Clearing Mch. Corp.
Hanna Engrg. Works
Hannifin Mfg. Co.
Hydraulic Products Co.
Skinner Chuck Co.

DEALERS, Machinery

Besly, Chas. H., & Co.
Earle Gear & Mch. Co.
Lunden & Bonthron
Ryerson, Joseph T., & Son, Inc.
Simmons Machine Tool Corp.

DEMAGNETIZERS

Blanchard Mch. Co.
Heald Machine Co.
Ideal Industries, Inc.
Walker, O. S., Co., Inc.

DESIGNERS, Machine and Tool

American Tool Engineering Co.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Jones, C. K., Inc.
Ruthman Mchry. Co.
Vinco Corporation

DIAMONDS and Diamond Tools

Desmond-Stephan Mfg. Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Smit, J. K., & Co.

DIE CASTING MACHINES

Hydraulic Press Mfg. Co.
Kux Machine Co.
Madison-Kipp Corp.
Reed-Prentice Corp.

DIE CASTING

See Castings, Die.

DIE CUSHIONS, Pneumatic

Bliss, E. W., Co.
Clearing Mch. Corp.
Verson Allsteel Press Co.

DIE INSERTS, Carbide

Carboloy Co., Inc.
Firth-Sterling Steel Co.
Kennametal, Inc.

DIE MAKERS' SUPPLIES

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Danly Mch. Specialties, Inc.
U. S. Tool Company, Inc.

DIE MAKING MACHINES

Grob Brothers
Kearney & Trecker Corp.
Oliver Instrument Co.

DIE SETS, Standard

Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.

where the job calls for HEAT RESISTANCE

get ABSCO-MEEHANITE castings

Among outstanding Absco-Meehanite castings are those of our Heat Resistant type. These castings are specially cast for long service life in work where high temperatures must be withstood year in and year out. Their specifications call for resistance to growth, warping and scaling under heat.

Heat resistance is combined with other Absco-Meehanite properties. A wide range of choice makes possible a close match between the metal and its service. The giant distributor plate assembly shown at the left, for instance, demanded strength, corrosion resistance and machinability to complement its first requisite — resistance to heat. In this unusual application, each of no less than 90 separate castings fits into a place of its own in the completed assembly.

"Unusual castings for unusual service" is more than a catchword at American Brake Shoe Company — it is a watchword for those seeking specification castings on a production basis — castings backed by a knowledge of foundry techniques that is unmatched in the industry. Write and tell us your specific needs.

AMERICAN Brake Shoe COMPANY

BRAKE SHOE AND CASTINGS DIVISION
230 Park Ave., New York 17, N. Y.

ABSCO-MEEHANITE PROPERTIES

1. Strength (Shear, Compressive, Tensile and Transverse)
2. Impact Resistance
3. Corrosion Resistance
4. Wear Resistance
5. Heat Resistance
6. Toughness
7. Rigidity
8. Machinability
9. Pressure Tightness
10. Vibration Absorption

Pratt & Whitney Co.
Producto Machine Co.

DIE SINKING MACHINES

Cincinnati Milling Mch. Co.
Gorton, George, Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.

DIE SINKING PRESSES

Baldwin-Southwark Corp.
Kearney & Trecker Corp.

DIE STOCKS

See Stocks, Die.

DIES, Lettering and Embossing

Noble & Westbrook Mfg. Co.
Sossner, Inc.

DIES

Sheet Metal, Etc.

Baumbach, E. A., Mfg. Co.
Bliss, E. W., Co.
Columbus Die, Tool & Mch. Co.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co
Ruthman Mchry. Co.
Taft-Peirce Mfg. Co.
Verson Allsteel Press Co.
V & O Press Co.
Wade Tool Co.
Waltham Mch. Wks.

Threading

Butterfield Div., Union Twist Drill Co
Card, S. W., Mfg. Co.
Eastern Mch. Screw Corp.
Geometric Tool Co.
Greenfield Tap & Die Corp.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Acme Co.
Oster Manufacturing Co.
Pratt & Whitney Co.
Standard Tool Co.

Threading Opening

Eastern Mch. Screw Corp.
Errington Mechanical Laboratory
Geometric Tool Co.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
National Acme Co.
Oster Manufacturing Co.

Thread Rolling

Hanson-Whitney Mch. Co.
Pratt & Whitney Co.

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Carborundum Co.
Gardner Mch. Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Simonds Abrasive Co.
Walls Sales Corp.

DIVIDING HEADS

See Index Centers.

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Allen Mfg. Co.
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
U. S. Tool Co., Inc.

DRAFTING MACHINES

Universal Drafting Machine Co.

DRAWING BOARDS AND TABLES

Universal Drafting Machine Co.

DRESSERS, Grinding Wheel

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Carboloy Co., Inc.
Desmond-Stephan Mfg. Co.
Hanchett Mfg. Co.
Ideal Industries, Inc.
Norton Co.
Smit, J. K., & Co.
Standard Tool Co.
Vinco Corporation

DRIFTS, DRILL

Armstrong Bros. Tool Co.
Standard Tool Co.

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Rehnberg-Jacobson Mfg. Co.

Multiple

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Barnes Drill Co.
Buffalo Forge Co.
Buhr Machine Tool Co.
Delta Manufacturing Co.
Errington Mechanical Laboratory
Ettco Tool Co.
Ex-Cell-O Corp.
Hoefer Mfg. Co.
Langelier Mfg. Co.
Moline Tool Co.
National Automatic Tool Co.
Thriftmaster Products, Div. Thomson Industries, Inc.

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Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

DRILL SPEEDERS

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Hoefer Mfg. Co.

DRILL STANDS

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Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Union Twist Drill Co.

DRILLING MACHINES

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Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F., & John Co.
Bodine Corp.
Bradford Machine Tool Co.
Buhr Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Hoefer Mfg. Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
National Automatic Tool Co.

Bench

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Atlas Press Co.
Avey Drilling Machine Co.
Buffalo Forge Co.
Delta Manufacturing Co.
Dumore Co.
Elgin Tool Wks., Inc.
Fosdick Machine Tool Co.
Henry & Wright Mfg. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
Production Machine Co.
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Walker-Turner Co., Inc.

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Foote-Burt Co.
Sellers, Wm., & Co., Inc.

Gang

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Baker Brothers, Inc.
Barnes Drill Co.
Cincinnati Bickford Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
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Fosdick Machine Tool Co.
Ingersoll Milling Mch. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Production Machine Co.
Producto Machine Co.
Sellers, Wm., & Co., Inc.

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Baker Brothers, Inc.
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Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Frew Machine Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
National Automatic Tool Co.
Sellers, Wm., & Co., Inc.
Sundstrand Mch. Tool Co.

Inverted

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Barnes Drill Co.

Multiple Center Column Type

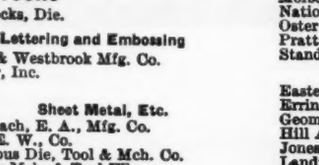
Barnes Drill Co.

Multiple Spindle

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.

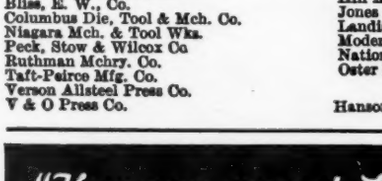
"How can we get Lower Stamping Costs?"

ONE Dieing Machine

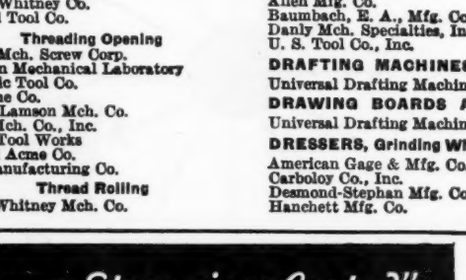


equals

5 to 10 conventional presses



Here's your answer—



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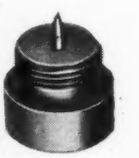

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See Speed Reducers.

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Detroit Bevel Gear Co.
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Earle Gear & Mch. Co.
Eberhardt-Denver Co.
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Ganschow Gear Co.
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Gleason Works
Grant Gear Wks., Inc.
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Massachusetts Gear & Tool Co.
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Michigan Tool Co.
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Stahl Gear & Machine Co.
Taylor Mch. Co.
Westinghouse Electric Corp.

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Earle Gear & Mch. Co.
Foote Bros. Gear & Machine Corp.
Ganschow Gear Co.
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Grant Gear Works, Inc.
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Pittsburgh Gear & Machine Co.
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Haskins, R. G., Co.

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Porter-Cable Machine Co.
Production Machine Co.
Walker-Turner Co., Inc.
Walls Sales Corp.

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Atlas Press Co.
Delta Manufacturing Co.
Hardinge Brothers, Inc.
Rivett Lathe & Grinder, Inc.
Ryerson, Joseph T., & Son, Inc.
Walker-Turner Co., Inc.

Broach

Gear Grinding Machine Co.

Camshaft

Landis Tool Co.
Norton Co.

Carbide Tool

Carboloy Co., Inc.
Ex-Cell-O Corp.
Oliver Instrument Co.

Centerless

Cincinnati Grinders, Inc.
Heald Machine Co.
Landis Tool Co.
Triplex Machine Tool Corp.

Chaser or Die

Eastern Mch. Screw Corp.
Fitchburg Grinding Mch. Corp.
Geometric Tool Co.
Landis Machine Co., Inc.

Chucking

Bryant Chucking Grinder Co.
Fitchburg Grinding Mch. Corp.

Crankshaft

Landis Tool Co.
Norton Co.

Cylinder

Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.

Cylindrical

Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Cincinnati Grinders, Inc.
Fitchburg Grinding Mch. Corp.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)
Morse Twist Drill & Mch. Co.
Norton Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Thompson Grinder Co.
Triplex Machine Tool Corp.

Disc

Besly, Chas. H., & Co.
Gardner Machine Co.
Hanchett Mfg. Co.
Porter-Cable Machine Co.
Production Mch. Co.

Drill

Delta Manufacturing Co.
Gallmeyer & Livingston Co.
Oliver Instrument Co.
Sellers, Wm., & Co., Inc.
Union Twist Drill Co.

Face

Abrasive Mch. Tool Co.
Hanchett Mfg. Co.
Oliver Instrument Co.

Flexible Shaft

See Flexible Shaft Equipment.

Gear Tooth

Gear Grinding Machine Co.
Pratt & Whitney Co.

For Sharpening Turning and Planing Tools

Delta Manufacturing Co.
Oliver Instrument Co.
Production Mch. Co.
Sellers, Wm., & Co., Inc.
Walker, O. S., Co., Inc.
Waltham Mch. Wks.

Internal

Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)
Rivett Lathe & Grinder, Inc.

Jig

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Radial, Ball Race, Etc.
Landis Tool Co.

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Consolidated Mch. Tool Corp.
Sundstrand Mch. Tool Co.

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Besly, Chas. H., & Co.
Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.

Roll
Farrel-Birmingham Co., Inc.
Landis Tool Co.
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Gear Grinding Machine Co.
Vinco Corporation

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DoAll Co.
Foote-Burt Co.
Gallmeyer & Livingston Co.
Gardner Mch. Co.
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Heald Machine Co.
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Producto Machine Co.
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Jones & Lamson Mch. Co.
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Gallmeyer & Livingston Co.
Ingersoll Milling Mch. Co.
Landis Tool Co.
LeBlond, R. K., Mch. Tool Co.
Norton Co.
Oliver Instrument Co.
Pratt & Whitney Co.
Thompson Grinder Co.
Union Twist Drill Co.

Worm
Gear Grinding Machine Co.
Jones & Lamson Mch. Co.
Pratt & Whitney Co.

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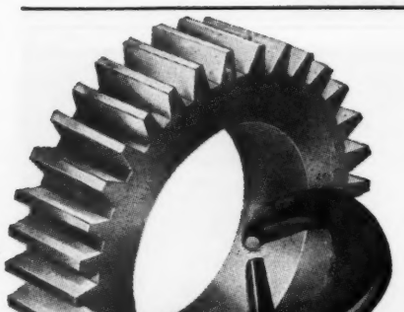

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See Boring Machines, Jig.

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Davis Keyseater Co.
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Norton Co.
Sommer & Adams Co.

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Hendey Machine Co.
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
McCrosky Tool Corp.
Monarch Mch. Tool Co.
Newton Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Sundstrand Mch. Tool Co.
Wade Tool Co.
Warner & Swasey Co.

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Williams, J. H., & Co.

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Cross Co.
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Goss & DeLeeuw Mch. Co.
Jones & Lamson Mch. Co.
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Lodge & Shipley Mch. Tool Co.
Monarch Mch. Tool Co.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Porter-Cable Machine Co.
Potter & Johnston Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.

Axles and Shaft

Consolidated Mch. Tool Corp.
Cross Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Sellers, Wm., & Co., Inc.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.

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Ames, B. C., Co.
Ames Precision Mch. Wks.
Atlas Press Co.
Elgin Tool Wks., Inc.
Hardinge Brothers, Inc.
LeBlond, R. K., Mch. Tool Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
South Bend Lathe Wks.
Stark Tool Co.
Wade Tool Co.

Boring

Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.

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Bardons & Oliver, Inc.
Gisholt Mch. Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.
Warner & Swasey Co.

Crankshaft

Consolidated Mch. Tool Corp.
Cross Co.
LeBlond, R. K., Mch. Tool Co.
Sundstrand Mch. Tool Co.

Double-End

Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Sundstrand Mch. Tool Co.

Engine and Toolroom

Acme Machine Tool Co.
American Tool Wks. Co.
Atlas Press Co.
Axelson Manufacturing Co.
Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
Hendey Machine Co.
LeBlond, R. K., Mch. Tool Co.
Lehmann Machine Co.
Lodge & Shipley Mch. Tool Co.
Logan Engineering Co.
Mackintosh & Hemphill Co.
Monarch Mch. Tool Co.
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Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
Sidney Machine Tool Co.
Simmonds Machine Tool Corp.
South Bend Lathe Wks.
Springfield Mch. Tool Co.

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LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Seneca Falls Mch. Co.
South Bend Lathe Wks.
Warner & Swasey Co.

Gun

Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.

Manufacturing Type

Lipe-Rollway Corporation
Lodge & Shipley Mch. Tool Co.

Spinning

See Chucking Machines.

Toolroom

See Lathes, Engine and Toolroom.

Turret

Acme Machine Tool Co.
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Foster Div., International Detrola Corp.
Gisholt Mch. Co.
Hardinge Brothers, Inc.
(Bench or Cabinet Mounting)
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Morey Machinery Co.
National Acme Co.
Oster Mfg. Co.
Potter & Johnston Mch. Co.
Production Machine Co.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Wade Tool Co.
Warner & Swasey Co.

Turret Automatic

Potter & Johnston Mch. Co.

Vertical Turret

Bullard Company
Rogers Machine Works, Inc.

LEVELS

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Starrett, L. S., Co.
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Gulf Oil Corp.
Shell Oil Co., Inc.
Sinclair Refining Co.
Socony Vacuum Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

LUBRICATING SYSTEMS

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Rivett Lathe & Grinder, Inc.

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See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

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Pratt & Whitney Co.
Scherr, George, Co., Inc.
Van Keuren Co.
Vinco Corporation

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American Measuring Instruments Corp.
Van Keuren Co.

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Elox Corp.

METALS, Bearing

See Bearings, Bronze, Babbitt, Etc. and Bushings, Brass, Bronze, Etc.

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Chicago Perforating Co.

METERS

See Recording Instruments.

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Pratt & Whitney Co.
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Starrett, L. S., Co.
Van Keuren Co.

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Scherr, George, Co., Inc.

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Consolidated Mch. Tool Corp.
Elgin Tool Wks., Inc.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Porter-Cable Machine Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Sundstrand Mch. Tool Co.
Van Norman Co.

MILLING MACHINES

Automatic

Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Jones & Lamson Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.
U. S. Tool Company, Inc.

Bench

Ames, B. C., Co.
Atlas Press Co.
Burke Machine Tool Co.
Hardinge Brothers, Inc.
(Bench or Pedestal Type)
Pratt & Whitney Tool Co.
Stark Tool Co.

Circular Continuous

Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.

Die Sinking

See Die Sinking Machines.

Duplex

Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Taylor & Fenn Co.

Hand

Burke Machine Tool Co.
Frew Machine Co.
Nichols, W. H., & Sons
Sundstrand Mch. Tool Co.
Van Norman Co.

Horizontal, Plain and Universal

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Frew Machine Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Machinery Mfg. Co.
Ohio Machine Tool Co.
Producto Machine Co.
Sidney Machine Tool Co.
Simmons Machine Tool Corp.
Sundstrand Mch. Tool Co.
Van Norman Mch. Tool Co.

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Sundstrand Mch. Tool Co.

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Consolidated Mch. Tool Corp.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Sellers, Wm., & Co., Inc.
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Planetary

Cross Gear & Machinery Co.

Ram Type, Universal

Van Norman Co.

Vertical

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Machinery Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Sidney Machine Tool Co.
Sommer & Adams Co.
Sundstrand Mch. Tool Co.
Taylor & Fenn Co.

MODEL AND EXPERIMENTAL WORK

See Special Machinery Tools.

MOLD AND DIE COPYING MACHINES

Gorton, George, Mch. Co.

MOLDING MACHINES, Plastic Products

Hydraulic Press Mfg. Co.
Reed-Prentice Corp.
Watson-Stillman Co.

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Climax Molybdenum

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General Electric Co.
Lincoln Electric Co.
Master Electric Co.
Reliance Electric & Engrg. Co.
Star Electric Motor Co.
Westinghouse Electric Corp.

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Raybestos-Manhattan, Inc., Manhattan Rubber Div.

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Baird Machine Co.
U. S. Tool Co., Inc.

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Noble & Westbrook Mfg. Co.

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Gray Machine Co,

NIPPLE THREADING MACHINERY

Landis Mch. Co., Inc.
Oster Manufacturing Co.

NUMBERING MACHINES

Noble & Westbrook Mfg. Co.

NUT MAKING MACHINERY

National Machinery Co.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Parker-Kalon Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)

NUTS, Self-Locking

Elastic Stop Nut Corp. of America

NUTS, Thumb or Wing and Cap

Republic Steel Corp.
(Union Drawn Steel Div.)
Williams, J. H., & Co.

OIL CAPS

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Gits Bros. Mfg. Co.
Trico Fuse Mfg. Co.

OIL EXTRACTORS

DeLaval Separator Co.

OIL GROOVERS

Hanson-Whitney Mch. Co.

OIL HOLE COVERS

Gits Bros. Mfg. Co.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co.
Madison-Kipp Corp.
Trico Fuse Mfg. Co.

OILS, Cutting

Cimcool Div., Cincinnati Milling Machine Co.
Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Lubricating

Besly, Chas. H., & Co.
Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Sinclair Refining Co.
Socony Vacuum Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.

Tide Water Associated Oil Co.

Quenching and Tempering

Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.

Soluble

See Compounds, Cutting, Grinding, Metal Drawings, Etc.

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Rehnberg-Jacobson Mfg. Co.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Garlock Packing Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.
Watson-Stillman Co.

PARALLELS

Brown & Sharpe Mfg. Co.
Johansson Div., Ford Motor Co.
Starrett, L. S., Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

PATTERNS, WOOD

Mummert-Dixon Co.

PHOSPHOR BRONZE—See Bronze.

PILLOW BLOCKS

Norma-Hoffmann Bearings Corp.
S K F Industries, Inc.
Standard Pressed Steel Co.

PIPE, BRASS AND COPPER

American Brass Co.

PIPE CUTTING AND THREADING MACHINES

Foote-Burt Co.
Landis Mch. Co., Inc.
Oster Manufactuirng Co.

PIPE JOINTS, SWIVEL

Chicksan Co.

PIPE, STEEL

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp. Div.)
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

PIPE TONGS

Williams, J. H., & Co.

PISTON PINS

Bell Engineering Co.

PLANER ATTACHMENTS

Cincinnati Planer Co.
Consolidated Mch. Tool Co.
Hanson-Whitney Mch. Co.
Rockford Machine Tool Co.

PLANERS

Baldwin-Southwark Corp.
Cincinnati Planer Co.
Consolidated Mch. Tool Corp.
(Incl. Plate, Rotary and Crank Types)
Ohio Machine Tool Co.
Rockford Machine Tool Co.
Sellers, Wm., & Co., Inc.

Openside

Cincinnati Planer Co.
Rockford Machine Tool Co.

PLASTICS and Plastic Products

Bakelite Corp.
Durez Plastics & Chemicals, Inc.

PLATE ROLLS

Baldwin-Southwark Corp.
Bethlehem Steel Co.
Cleveland Punch & Shear Wks. Co.
Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

PLATES, Surface

Brown & Sharpe Mfg. Co.
Ideal Industries, Inc.
Jones Machine Tool Wks., Inc
Rotor Tool Co.
Scherr, George, Co., Inc.
Taft-Peirce Mfg. Co.
U. S. Tool Company, Inc.
Vinco Corporation

PNEUMATIC EQUIPMENT

Bliss, E. W., Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Ingersoll-Rand Co.
Logansport Machine Co., Inc.
Valvair Corp.

POLISHING LATHES and Machines

Besly, Chas. H., & Co.
Bridgeport Safety Emery Wheel Co., Inc.
DoAll Co.
Gardner Machine Co.
Production Mch. Co.
Sundstrand Mch. Tool Co.

POLISHING TOOLS, Portable

Stow Mfg. Co.
Strand, N. A., & Co.

PRESSES

Arbor

Baldwin-Southwark Corp.
Dake Engine Co.
Elmes Engineering Works
Famco Machine Co.
Farquhar, A. B., Co.
General Manufacturing Co.
Hannifin Mfg. Co.
Lempco Products, Inc.
Logansport Machine Co., Inc.
Sheldon Mch. Co.
Watson-Stillman Co.
Wilson, K. R.

Broaching

American Broach & Mch. Co.
Bliss, E. W., Co.
General Manufacturing Co.
Lapointe Machine Tool Co.
Oilgear Co.
Peck, Stow & Wilcox Co.
V & O Press Co.
Watson-Stillman Co.

Extrusion

Hydraulic Press Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
National Machinery Co.
Watson-Stillman Co.

Foot

Baird Machine Co.
Bliss, E. W., Co.
Etna Machine Co.
Famco Machine Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Taylor & Fenn Co.
V & Press Co.

Forging

Ajax Manufacturing Co.
Baldwin-Southwark Corp.
Bethlehem Steel Co.
Bliss, E. W., Co.
Clearing Mch. Co.
Cleveland Punch & Shear Works Co.
Farquhar, A. B., Co.
Henry & Wright Mfg. Co.
Hydraulic Press Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.
National Machinery Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Verson Allsteel Press Co.
V & O Press Co.
Watson-Stillman Co.
Zeh & Hahnemann Co.

Hydraulic

American Broach & Mch. Co.
Baldwin-Southwark Corp.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Bliss, E. W., Co.
Clearing Mch. Co.
Dake Engine Co.
Denison Engineering Co.
Elmes Engineering Works
Farrel-Birmingham Co., Inc.
Farquhar, A. B., Co.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Co.
Lapointe Machine Tool Co.
Morgan Engineering Co.
Oilgear Co.
Verson Allsteel Press Co.
Warren City Mfg. Co.
Watson-Stillman Co.
Wilson, K. R.

Percussion

Wilson, K. R.

Screw

Bliss, E. W., Co.
General Manufacturing Co.
Niagara Machine & Tool Wks.
Zeh & Hahnemann Co.

Sheet Metal Working

Baldwin-Southwark Corp.
Bliss, E. W., Co.
Cincinnati Shaper Co.
Clearing Mch. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. & Tool Corp.
Famco Machine Co.
Farquhar, A. B., Co.
Henry & Wright Mfg. Co.
Hydraulic Press Mfg. Co.
L & J Press Corp.
Lake Erie Engineering Corp.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Verson Allsteel Press Co.
V & O Press Co.
Warren City Mfg. Co.
Watson-Stillman Co.
Zeh & Hahnemann Co.

Straightening

Baldwin-Southwark Corp.
Consolidated Mch. Tool Corp.
Elmes Engineering Works
Farquhar, A. B., Co.
General Manufacturing Co.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Jones Machine Tool Wks., Inc.
Lempco Products, Inc.
Morgan Engineering Co.
Oilgear Co.
Springfield Mch. Tool Co.
Watson-Stillman Co.

PRINT PAPER, BLUE, WHITE, ETC.

Ozalid Products Div. General Aniline & Film Corp.

PROFILING MACHINES

Consolidated Mch. Tool Corp.
Frew Machine Co.
Gorton, George, Mch. Co.
Leland-Gifford Co.
Morey Machinery Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.
Wade Tool Co.

PULLEYS

Boston Gear Works, Inc.
DoAll Co.
Foote Bros. Gear & Machine Corp.
Hill Acme Co.
Sellers, Wm., & Co., Inc.

Friction Clutch

Brown & Sharpe Mfg. Co.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Ingersoll-Rand Co.
Logansport Machine Co., Inc.
Ruthman Machinery Co.
Tuthill Pump Co.
Viking Pump Co.

Hydraulic

Baldwin-Southwark Corp.
Barnes, John S., Corp.
Bethlehem Steel Co.
Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Elmes Engineering Works
Hydropress Co., Inc.
Ingersoll-Rand Co.
Lapointe Machine Tool Co.
McIntyre Co.
Oilgear Co.
Sundstrand Mch. Tool Co.
Tuthill Pump Co.
Viking Pump Co.
Watson-Stillman Co.

Pneumatic

Ingersoll-Rand Co.

Rotary

Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Tuthill Pump Co.
Viking Pump Co.

PUNCHES AND DIES

See Dies, Sheet Metal, Inc.

PUNCHES, CENTERING

Cleveland Punch & Shear Works Co.

PUNCHING MACHINERY

Buffalo Forge Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.

"DIE-LESS" DUPLICATING SAVES MAN HOURS and DELAYS

DIE ACCURACY WITHOUT DIES

Send for CATALOG

"DIE-LESS" DUPLICATING
The DI-ACRO System of METAL DUPLICATING Without Dies

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LUERS

PATENTED CUTTING OFF TOOL HOLDERS
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ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

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COMMERCIAL TOOL HARDENING AND HEAT TREATING

Strictly Modern Equipment, Backed by the Skill and Judgment of 30 Years Experience. Also, We Sell "Heat-Easy" Compound for Pack Hardening High Speed and High Carbon—High Chrome Steels.

THE BENNETT METAL TREATING COMPANY, Elmwood, Conn.

Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Ryerson, Joseph T., & Son, Inc.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Watson-Stillman Co.
Wiedemann Machine Co.

PUNCHING AND RIVETING MACHINES

Hannifin Mfg. Co.

PYROMETERS

Bristol Co.
Leeds & Northrup Co.
Shore Instrument & Mfg. Co.

RACK CUTTING MACHINES AND ATTACHMENTS

Gould & Eberhardt

RACKS, GEAR, CUT

Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Brown & Sharpe Mfg. Co.
Fellows Gear Shaper Co.
Foote Bros. Gear & Machine Corp.
Hartford Special Mchry. Co.
Massachusetts Gear & Tool Co.
Meisel Press Mfg. Co.
Philadelphia Gear Works
Stahl Gear & Machine Co.

REAMER HOLDERS

Gairing Tool Co.
Gisholt Machine Co.
Landis Mch. Co., Inc.
Lipe-Rollway Corporation
McCrosky Tool Corp.
Scully-Jones & Co.
Warner & Swasey Co.

REAMERS

Barber-Colman Co.
Butterfield Div., Union Twist Drill Co.
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Columbus Die, Tool & Mch. Co.
Ex-Cell-O Corporation
Firth-Sterling Steel Co.
Gairing Tool Co.
Gammons-Hoaglund Co.
Genesee Tool Co.
Gisholt Machine Co.
Greenfield Tap & Die Corp.
Haynes Stellite Co.
Illinois Tool Wks.
Lipe-Rollway Corporation
McCrosky Tool Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Tungsten Carbide Tool Co.
Union Twist Drill Co.

Adjustable

Barber-Colman Co.
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Ex-Cell-O Corporation
Firth Sterling Steel Co.
Gairing Tool Co.
Gisholt Machine Co.
Greenfield Tap & Die Corp.
McCrosky Tool Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.
Rogers, John M., Tool Corp.
Standard Tool Co.
Taft-Peirce Mfg. Co.
Union Twist Drill Co.

Taper Pin

Butterfield Div,. Union Twist Drill Co.
Gammons-Hoaglund Co.
Greenfield Tap & Die Corp.
Lipe-Rollway Corporation
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

REAMING MACHINES

Van Norman Co.

RECORDING INSTRUMENTS

For Counting

National Acme Co.

For Electricity

Bristol Co.
General Electric Co.
Leeds & Northrup Co.

For Pressure

Bristol Co.
Leeds & Northrup Co.

For Speed

Bristol Co.
Leeds & Northrup Co.

For Temperature

Bristol Co.
Leeds & Northrup Co.

REELS, Stock, Standard and Automatic

8 & 8 Mch. Wks.
U. S. Tool Company, Inc.

REFRACTORIES, Heat Treating Furnace

Norton Co.

REGULATORS, Temperature

Bristol Co.
General Electric Co.
Leeds & Northrup Co.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc.

RETAINING RINGS FOR BEARINGS, ETC.

Waldes Kohinoor, Inc.

RHEOSTATS

Allen-Bradley Co.
General Electric Co.

RIVET SETS

Bethlehem Steel Co.
Cleveland Pneumatic Tool Co.
Cleveland Punch & Shear Works Co.

RIVETERS, Hydraulic

Bethlehem Steel Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Morgan Engineering Co.

Pneumatic

Cleveland Pneumatic Tool Co.
Grant Mfg. & Mch. Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Ingersoll-Rand Co.
Ryerson, Joseph T., & Son, Inc.

RIVETING MACHINES

Buffalo Forge Co.
General Riveters, Inc.
Grant Mfg. & Mch. Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Peck, Stow & Wilcox Co.
Producto Machine Co.

RIVET MAKING MACHINES

Hill Acme Co.
National Machinery Co.

RIVETS

Republic Steel Corp., (Union Drawn Steel Div.)

RUBBER PRODUCTS

Raybestos-Manhattan, Inc., Manhattan Rubber Div.

RULES, Steel

Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

RUST PREVENTATIVE

National Oil Products Co.
Oakite Products, Inc.
Scherr, George, Co., Inc.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

SANDERS

Carborundum Co.
Delta Manufacturing Co.
Ingersoll-Rand Co.
Porter-Cable Machine Co.
Rotor Tool Co.
Sand-O-Flex Corp.
Sundstrand Mch. Tool Co.
Walls Sales Corp.

SAW BLADES, HACK

Armstrong-Blum Mfg. Co
Simonds Saw & Steel Co
Starrett, L. S., Co.

SAW SHARPENING MACHINES

Earle Gear & Mch. Co.
Huther Bros. Saw Mfg. Co., Inc.
Scherr, George, Co., Inc.

SAWING MACHINES

Circular

Consolidated Mch. Tool Corp.
Earle Gear & Mch. Co.
Etna Machine Co.

Friction

Ryerson, Joseph T., & Son, Inc.

Metal Cutting Band

Armstrong-Blum Mfg. Co.
Avey Drilling Machine Co.
Delta Manufacturing Co.
DoAll Co.
Grob Brothers
Huther Bros. Saw Mfg. Co., Inc.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.

Power Hack

Armstrong-Blum Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

SAWS, Circular Metal Cutting

Brown & Sharpe Mfg. Co.
Consolidated Mch. Tool Corp.
Espen-Lucas Machine Works
Genesee Tool Co.
Huther Bros. Saw Mfg. Co., Inc.
Illinois Tool Wks.
National Twist Drill & Tool Co.
Simonds Saw & Steel Co.
Standard Tool Co.
Union Twist Drill Co.
Walker-Turner Co., Inc.

Metal Cutting Band

Armstrong-Blum Mfg. Co.
Delta Mfg. Co.
DoAll Co., Inc.
Huther Bros. Saw Mfg. Co., Inc.
Ryerson, Joseph T., & Son, Inc.
Starrett, L. S., Co.
Tannewitz Works
Walker-Turner Co., Inc.
Wells Manufacturing Corp.

Screw Slotting

Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Simonds Saw & Steel Co.
Standard Tool Co.
Starrett, L. S., & Co.
Union Twist Drill Co.

SCRAPERS, Hand & Power

Anderson Bros. Mfg. Co.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Errington Mechanical Laboratory
Haskins, R. G., Co.
Ingersoll-Rand Co.
Procunier Safety Chuck Co.
Strand, N. A., & Co.

SCREW MACHINES, Automatic, Single and Multiple Spindle

Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Cone Automatic Machine Co., Inc.
Foote-Burt Co.
Greenlee Bros. & Co.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Scherr, George, Co., Inc.
Triplex Machine Tool Corp.

SCREW MACHINES, Hand

See also Lathes, Turret.
Acme Machine Tool Co.
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Gisholt Mch. Co.
Hardinge Brothers, Inc.
Jones & Lamson Machine Co.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
Stark Tool Co.
Wade Tool Co.
Warner & Swasey Co.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Gisholt Mch. Co.
Greenlee Bros. & Co.
Jones & Lamson Machine Co.
Landis Mch. Co., Inc.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Potter & Johnston Machine Co.
R and L Tools
Warner & Swasey Co.

SCREW MACHINE WORK

Aluminum Co. of America
Eastern Mch. Screw Corp.
Morse Twist Drill & Mch. Co.
National Acme Co.
Standard Pressed Steel Co.

SCREW PLATES

Bealy, Chas. H., & Co.
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.

SCREWS

Cap, Set, Safety Set and Machine

Allen Mfg. Co.
American Hardware Co.
American Screw Co.
Atlas Bolt Screw Co.
Bristol Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Co.
Elco Tool & Screw Corp.
General Screw Mfg. Co.
Harper, H. M., & Co.
Holo-Krome Screw Corp.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet & Machine Co.
National Acme Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker, Chas., Co.
Parker-Kalon Corp.
Pawtucket Screw Co.
Pheoll Mfg. Co.
Reading Screw Co.
Republic Steel Corp. (Union Drawn Steel Div.)
Russell, Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.
Southington Hardware Co.
Standard Pressed Steel Co.
Steel Co. of Canada, Ltd.
Sterling Bolt Co.
Whitney Screw Corp.
Wolverine Belt Co.

SCREWS, Self-Tapping Drive

Parker-Kalon Corp.

SCREWS, Thumb

American Screw Co.
Parker-Kalon Corp.
Williams, J. H., & Co.

SEALS AND RETAINERS

Oil or Grease

Garlock Packing Co.
Gits Bros. Mfg. Co.

SEAMLESS STEEL TUBING

See Tubing, Seamless Steel.

SECOND HAND MACHINERY, Etc.

Cincinnnati Machinery & Supply Co.
Eastern Machinery Co.
Miles Machinery Co.
Morey Mchry. Co., Inc.
Simmons Machine Tool Corp.

SEPARATORS, CENTRIFUGAL

DeLaval Separator Co.

SEPARATORS, Oil or Coolant

Barnes Drill Co.
National Acme Co.

SHAFTING, STEEL

Bethlehem Steel Co.
Cumberland Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.
Standard Pressed Steel Co.

SHAFTS

Flexible

Haskins, R. G., Co.
Stewart, F. W., Mfg. Co.
Strand, N. A., & Co.

Hollow Bored

American Hollow Boring Co.
Bethlehem Steel Co.

Turned and Ground

Bethlehem Steel Co.
Cumberland Steel Co.
Jones & Laughlin Steel Corp.
Ryerson, Joseph T., & Son, Inc.

SHAPERS

American Tool Works Co.
Atlas Press Co.
Cincinnati Shaper Co.
General Engrg. & Mfg. Co.
Hendey Machine Co.
Machinery Mfg. Co.
Ohio Machine Tool Co.
Rockford Mch. Tool Co.
Smith & Mills Co.

Vertical

Hanson-Whitney Mfg. Co.
Jones Machine Tool Wks., Inc.
Pratt & Whitney Co.
Rhodes Manufacturing Co.
Rockford Machine Tool Co.

SHAPES, Structural

Aluminum Co. of America
Bethlehem Steel Co.
Cramp Brass & Iron Foundries Div.
Jones & Laughlin Steel Corp.

SHEARING MACHINERY

Bethlehem Steel Co.
Buffalo Forge Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Hydropress Co., Inc.
Morgan Engineering Co.
Niagara Mch. & Tool Wks.
O'Neil-Irwin Mfg. Co.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Ryerson, Joseph T., & Son, Inc.
Watson-Stillman Co.
Yoder Co.

SHEARS, Alligator

Hill Acme Co.

SHEARS

Rotary

Bliss, E. W., Co.
Brown & Sharpe Mfg. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Ryerson, Joseph T., & Son, Inc.
Union Twist Drill Co.

Squaring

Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.

SHEET METALS

Aluminum Co. of America
American Brass Co.
Associated Metals
Bethlehem Steel Co.
Ryerson, Joseph T., & Son, Inc.

SHEETS, Iron & Steel

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp. (Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

Perforated

Chicago Perforating Co.

SINE BARS

Johansson Div., Ford Motor Co.
Starrett, L. S., Co.
Vinco Corporation

SLEEVES

Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

SLOTTING MACHINES

Baker Brothers, Inc.
Consolidated Mch. Tool Corp.
Jones Machine Tool Wks., Inc.
Rockford Mch. Tool Co.
Sellers, Wm., & Co., Inc.

SOCKETS

Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.

National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.
Williams, J. H., & Co.

SOLDER FOR ALUMINUM AND CAST IRON

Cramp Brass & Iron Foundries Div.

SPECIAL MACHINERY AND TOOLS

American Measuring Instruments Corp.
American Type Foundries, Inc.
Baird Machine Co.
Baldwin-Southwark Corp.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bethlehem Steel Co.
Bilgram Gear & Mch. Wks.
Birdsboro Steel Fdy. & Mch. Co.
Blanchard Machine Co.
Bliss, E. W., Co.
Columbus Die, Tool & Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Denison Engineering Co.
Earle Gear & Mch. Co.
Elgin Tool Wks., Inc.
Ex-Cell-O Corp.
Farrel-Birmingham Co., Inc.
Gairing Tool Co.
Gisholt Mch. Co.
Gorton, George, Mch. Co.
Grant Mfg. & Mch. Co.
Greenlee Bros. & Co.
Hannifin Mfg. Co.
Hartford Special Mchry. Co.
Hydraulic Press Mfg. Co.
Hill Acme Co.
Ingersoll Milling Mch. Co.
Jack & Heintz Precision Industries, Inc.
Jones, C. K., Inc.
Jones Machine Tool Wks., Inc.
Lake Erie Engineering Corp.
Langelier Mfg. Co.
Lipe-Rollway Corporation
Moline Tool Co.
Morgan Engineering Co.
Morse Twist Drill & Mch. Co.
National Acme Co.
National Automatic Tool Co.
National Twist Drill & Tool Co.
New Britain-Gridley Mch. Div., New Britain Mch. Co.
New Jersey Gear & Mfg. Co.
Niagara Mch. & Tool Wks.
Oilgear Co.
Peck, Stow & Wilcox Co.
Pratt & Whitney Co.
Reed-Prentice Co.
Rogers, John M., Tool Corp.
Ruthman Machinery Co.
S. & S. Mch. Works
Sundstrand Mch. Tool Co.
Taft-Peirce Mfg. Co.
Union Twist Drill Co.
U. S. Tool Company, Inc.
V & O Press Co.
Wade Tool Co.
Waltham Mfg. Wks.

SPEED REDUCERS

Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Cleveland Worm & Gear Co.
Davis & Thompson Co.
DeLaval Steam Turbine Co.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Ganschow Gear Co.
General Electric Co.
Grant Gear Works, Inc.
Master Electric Co.
Michigan Tool Co.
Morse Chain Co.
Philadelphia Gear Works
Shepard Niles Crane & Hoist Corp.

SPINDLES, Grinding

Ex-Cell-O Corporation
Pope Machinery Corp.

SPINDLES, Hollow Bored

American Hollow Boring Co.

SPINNING LATHES

See Chucking Machines.

SPRING COILING AND FORMING MACHINERY

Baird Machine Co.

SPROCKET CHAINS

Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Grant Gear Works, Inc.
Morse Chain Co.
Philadelphia Gear Works

SPROCKETS

Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Eberhardt-Denver Co.
Foote Bros. Gear & Machine Corp.
Grant Gear Works, Inc.
Hartford Special Mchy. Co.
Morse Chain Co.
Philadelphia Gear Works

STAMPINGS, Sheet Metal

Aluminum Co. of America
Quadriga Mfg. Co.

STAMPINGS, Steel

Worcester Pressed Steel Co.

STAMPS, Steel, and Marking Dies

Noble & Westbrook Mfg. Co.
Pittsburgh Stamp Co., Inc.
Sossner, Inc.

STEEL

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel Co.
Frasse, Peter A., & Co., Inc.
Holliday, W. J., & Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Timken Roller Bearing Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Cold Drawn

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel Co.
Jones & Laughlin Steel Corp.
Rustless Iron & Steel Div., American Rolling Mills Co.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Wheelock, Lovejoy & Co., Inc.

Composite Tool and Die

Firth-Sterling Steel Co.

High Speed Tool

Allegheny Ludlum Steel Corp.
Armstrong Bros. Tool Co.
Bethlehem Steel Co.
Carpenter Steel Co.
Cleveland Twist Drill Co.
Crucible Steel Co. of America
Firth-Sterling Steel Co.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Machine

Bethlehem Steel Co.
Crucible Steel Co. of America
Holliday, W. J., & Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Rustless

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel Co.
Ingersoll Steel & Disc Div. Borg-Warner Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Rustless Iron & Steel Div. American Rolling Mills Co.

Stainless

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel Co.
Frasse, Peter A., & Co., Inc.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Rustless Iron & Steel Div. American Rolling Mills Co.
Timken Roller Bearing Co.
Wheelock, Lovejoy & Co., Inc.

Strip and Sheet

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Frasse, Peter A., & Co., Inc.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp.

STEEL ALLOYS

See Alloy Steels.

STEEL BARS—See Bars, Steel.

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.

STELLITE

Haynes Stellite Co.

STOCKS, Die

Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Oster Manufacturing Co.
Pratt & Whitney Co.
Standard Tool Co.

STONES, Oil or Sharpening

Bay State Abrasive Co.
Carborundum Co.

STOOLS

Standard Pressed Steel Co.

STRAIGHT EDGES

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Johansson Div., Ford Motor Co.
Jones Machine Tool Wks., Inc.
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STRAIGHTENING MACHINERY

Baldwin-Southwark Corp.
Consolidated Mch. Tool Corp.
General Manufacturing Co.
Hannifin Mfg. Co.
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Lake Erie Engineering Corp.
Morse Twist Drill & Mch. Co.
Oilgear Co.
Springfield Mch. Tool Co.
Waterbury Farrel Fdry. & Mch. Co.

STUD SETTERS

Errington Mechanical Laboratory
Modern Tool Wks.
Procunier Safety Chuck Co.

SUB PRESSES

Baumbach, E. A., Mfg. Co.
U. S. Tool Co.
Waltham Mch. Wks.

SUPERFINISHING MACHINES

Norton Co.

SURFACE PLATES

See Plates, Surface.

SWAGING MACHINES

Cincinnati Shaper Co.
Etna Machine Co.
Langelier Mfg. Co.
Torrington Co.

SWITCHES

Allen-Bradley Co.
General Electric Co.
Lincoln Electric Co.
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Shepard Niles Crane & Hoist Corp.
Westinghouse Electric Corp.

TACHOMETERS

Bristol Co.
Ideal Industries, Inc.
Leeds & Northrup Co.
Scherr, George, Co., Inc.
Sticht, Herman H., Co., Inc.
Veeder-Root, Inc.

TAPER PINS, STANDARD

Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.

TAP EXTENSIONS

Allen Mfg. Co.

TAP HOLDERS

Errington Mechanical Laboratory
Gairing Tool Co.
McCrosky Tool Corp.
National Automatic Tool Co.
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Scully-Jones & Co.

TAPPING ATTACHMENTS AND DEVICES

Avey Drilling Machine Co.
Baker Brothers, Inc.
Brown & Sharpe Mfg. Co.
Buhr Machine Tool Co.
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TAPPING MACHINES

Armstrong-Blum Mfg. Co.
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bodine Corp.
Bradford Machine Tool Co.
Buffalo Forge Co.
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Cross Co.
Detroit Tap & Tool Co.
Elgin Tool Wks., Inc.
Frew Machine Co.
Geometric Tool Co.
Greenlee Bros. & Co.
Haskins, R. G., Co.
Hill Acme Co.
Hoefer Mfg. Co.
Kaufman Manufacturing Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
Leland-Gifford Co.
Modern Tool Wks.
Moline Tool Co.
National Acme Co.
National Automatic Tool Co.
Procunier Safety Chuck Co.
Viking Tool & Mch. Corp.
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TAPPING MACHINES, Nut

Hill Acme Co.

TAPS

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Besly, Chas. H., & Co.
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Continental Tool Works Div.
Detroit Tap & Tool Co.
Electrolized Tap Corp.
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Hanson-Whitney Mch. Co.
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Morse Twist Drill & Mch. Co.
National Acme Co.
Pratt & Whitney Co.
Standard Tool Co.
Threadwell Tap & Die Co.
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Collapsing

Geometric Tool Co.
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Hydraulic Press Mfg. Co.

THERMOMETERS, Indicating and Recording

Bristol Co.
Leeds & Northrup Co.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co.
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THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Coulter, James, Machine Co.
Cross Co.
Hanson-Whitney Mch. Co.
Pratt & Whitney Co.
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THREAD ROLLING MACHINES

Hill Acme Co.
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TIN AND TERNE PLATES

Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)

TOOL BITS

High Speed Steel

Allegheny Ludlum Steel Corp.
Armstrong Bros. Tool Co.
Barber-Colman Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel Co.
Illinois Tool Wks.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.
Williams, J. H., & Co.

Special Alloy

Allegheny Ludlum Steel Corp.
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Haynes Stellite Co.

TOOL GRINDERS

See Grinders for Sharpening Turning and Planing Tools.

TOOL HEADS, Adjustable

Gairing Tool Co.

TOOLHOLDERS

Armstrong Brothers Tool Co.
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Lovejoy Tool Co., Inc.
Michigan Tool Co.
R and L Tools
Scully-Jones & Co. (turret)
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Firth-Sterling Steel Co.
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Kennametal, Inc.
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TRANSFORMERS
General Electric Co.

TRANSMISSION MACHINERY
See Hangers, Shafting, Pulleys, Clutches, Coupling, Belting, Chains, Etc.

TRANSMISSION, Variable Speed
DoAll Co.
Ideal Industries, Inc.
Oilgear Co.
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TUBE FLANGING MACHINES
Grant Mfg. & Mch. Co.

TUBING, Aluminum
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TUBING
Brass and Copper
American Brass Co.
Flexible
Titeflex, Inc.
Stainless Steel
Allegheny Ludlum Steel Corp.
Carpenter Steel Co.
National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Steel and Seamless Steel
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Frasse, Peter A., & Co., Inc.
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National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.

TUMBLING BARRELS
Baird Machine Co.

TUNGSTEN CARBIDE
Allegheny Ludlum Steel Corp.
Carboloy Co., Inc.
Firth-Sterling Steel Co.
Kennametal, Inc.
Metal Carbides Corp.

TWIST DRILLS
See Drills, Twist.

UNIONS
Dart, E. M., Mfg. Co.

UNIT HEATERS
Murray, D. J., Mfg. Co.

UNIVERSAL JOINTS
Baush Machine Tool Co.
Boston Gear Works, Inc.
National Automatic Tool Co.

V-BELTS
Manheim Mfg. & Belting Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

VALVES
Hydraulic
Baldwin-Southwark Corp.
Barnes, John S., Corp.
Elmes Engineering Works
Galland-Henning Mfg. Co.
Hannifin Mfg. Co.
Hydraulic Products Co.
Logansport Machine Co., Inc.
Oilgear Co.
Sundstrand Mch. Tool Co.
Valvair Corp.
Watson-Stillman Co.
Pneumatic
Hanna Engineering Works
Hannifin Mfg. Co.
Murray, D. J., Mfg. Co.

VISES
Bench
Avey Drilling Machine Co.
Desmond-Stephan Mfg. Co.
Vinco Corporation
Machine
Armstrong-Blum Mfg. Co.
Armstrong Brothers Tool Co.
Avey Drilling Machine Co.
Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Desmond-Stephan Mfg. Co.
Graham Mfg. Co., Inc.
Hannifin Mfg. Co.
Jefferson Machine Tool Co.
LeBlond, R. K., Mch. Tool Co.
Logansport Machine Co., Inc.
Sheldon Mch. Co.
Skinner Chuck Co.
Pipe
Greenfield Tap & Die Corp.
Williams, J. H., & Co.
Planer and Shaper
Brown & Sharpe Mfg. Co.
Cincinnati Planer Co.
Cincinnati Shaper Co.
Graham Mfg. Co., Inc.
Hendey Machine Co.
Rockford Machine Tool Co.
Skinner Chuck Co.

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Jordanoff Corp.

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Bristol Co.
General Electric Co.

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Quadriga Mfg. Co.
Spring
Quadriga Mfg. Co.

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Air Reduction Sales Co.
Linde Air Products Co.

WELDING AND CUTTING GASES
Air Reduction Sales Co.
Linde Air Products Co.

WELDING EQUIPMENT,
Electric Arc
Air Reduction Sales Co.
General Electric Co.
Lincoln Electric Co.
Master Electric Co.
Westinghouse Electric Corp.
Electric, Spot, Butt, Seam, Etc.
Federal Machine & Welder Co.
Taylor-Winfield Corp.
Victory Engrg. & Mch. Wks., Inc.

WELDING POSITIONER
Cullen-Friestedt Co.
Ransome Machinery Co.

WHITE PRINTS, Paper and Machine
Ozalid Div., General Aniline & Film Corp.

WIRE
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp., (Union Drawn Steel Div.)
Rustless Iron & Steel Div. American Rolling Mills Co.

WIRE FORMING MACHINERY
Baird Machine Co.
U. S. Tool Co., Inc.

WIRE NAIL MACHINERY
Bliss, E. W., Co.
National Machinery Co.
Ryerson, Joseph T., & Son, Inc.

WOOD SCREW MACHINERY
Cook, Asa S., Co.

WOODWORKING MACHINERY
Sidney Machine Tool Co.
Walker-Turner Co., Inc.

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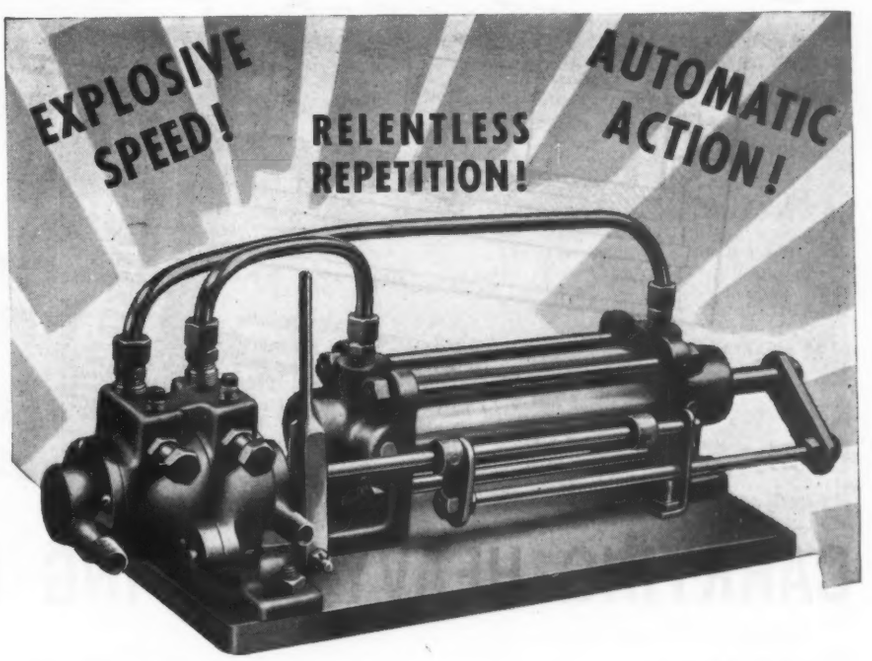
Cleveland Worm & Gear Co.
DeLaval Steam Turbine Co.
Philadelphia Gear Works

WRENCHES
Armstrong Brothers Tool Co.
Standard Tool Co.
Williams, J. H., & Co.
Detachable Socket
Williams, J. H., & Co.
Pipe
Greenfield Tap & Die Corp.
Ratchet
Williams, J. H., & Co.
Tap
Besly, Chas. H., & Co.
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.
Standard Tool Co.
Torque Measuring
Elastic Stop Nut Corp. of America
Williams, J. H., & Co.



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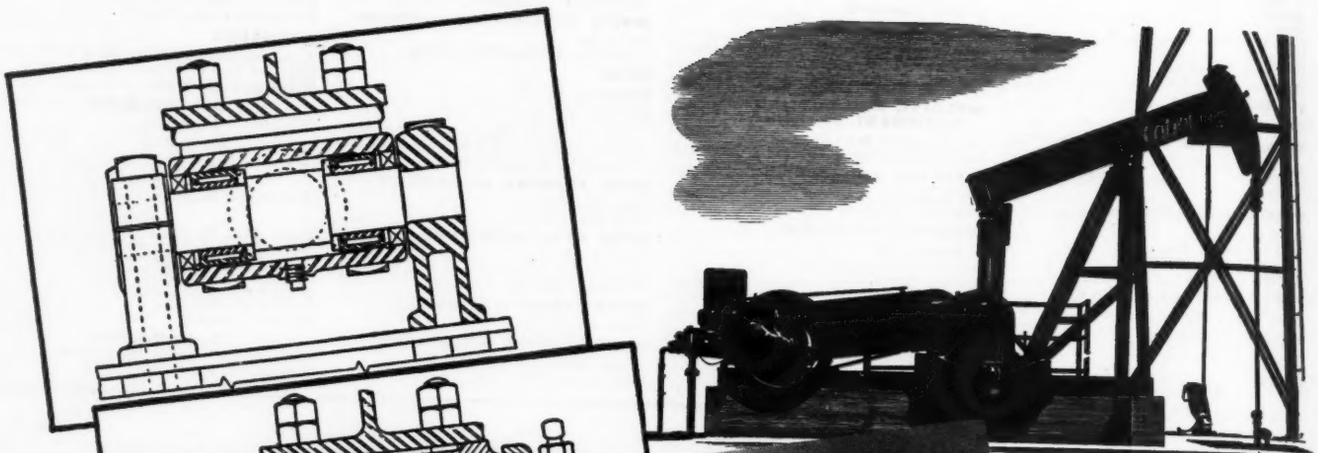

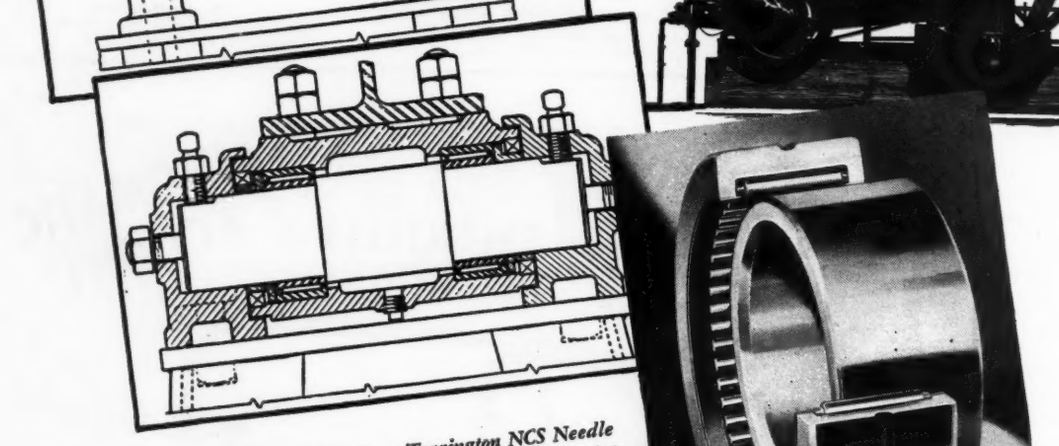

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Specifically designed to carry heavy loads, compact and sturdy Torrington NCS Needle Bearings are the outstanding choice for saddle, pitman and other applications in pumping units. Engineered to give you long, trouble-free service ...they help units function smoothly and quietly —and with minimum output in power.

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This Self-Aligning Spherical Roller Bearing is manufactured as a complete unit for easy handling and installation, and will be available in a full range of sizes from 1.5748" bore and up. Write for further information or consult your nearest Torrington Representative.

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ALPHABETICAL INDEX OF ADVERTISERS

A

Abrasive Machine Tool Co. 385
Ace Manufacturing Corp. 356
Acme Machine Tool Co. 377
Allegheny Ludlum Steel Corp.. 295
Allen-Bradley Co.....Insert bet. 42-45
Allen Mfg. Co. 412
American Brake Shoe Co..... 425
American Brass Co..... 255
American Broach & Mch. Co., Insert bet. 68-83
American Hdwe. Corp..... 249
American Hollow Boring Co..... 410
American Optical Co. 122
American Screw Co. 52-249
American Tool Works Co.....20-21
Ampco Metal, Inc. 423
Anderson Brothers Mfg. Co., Insert bet. 68-83
Arguto Oilless Bearing Co..... 407
Armstrong-Blum Mfg. Co..... 399
Armstrong Bros. Tool Co. 324
Arter Grinding Machine Co. 388
Atlantic Gear Works..... 404
Atlantic Screw Works..... 249
Atlas Bolt & Screw Co. 249
Automotive Gear Works, Inc. .. 137
Avey Drilling Machine Co. 383
Axelson Manufacturing Co., Insert bet. 128-131

B

Baird Machine Co. 368
Baker Brothers, Inc..... 311
Baldwin Locomotive Works, Locomotive & Southwark Div. 50
Ball & Roller Bearing Co..... 407
Bantam Bearings Div. Torrington Co. 438
Barber-Colman Co., Insert bet. 68-83
Bardons & Oliver, Inc..... 64
Barnes Drill Co.....Insert bet. 68-83
Barnes, W. F. & John, Co., Insert bet. 68-83
Bath, John, & Co., Inc..... 277
Baumbach, E. A., Mfg. Co..... 366
Baush Machine Tool Co. 106
Bay State Abrasive Products Co. 284
Bell Engineering Co..... 260
Bennett Metal Treating Co..... 434
Besly, Chas. H., & Co..... 389
Bethlehem Steel Co. 101
Bilgram Gear & Machine Works 404
Blanchard Machine Co. 355
Bodine Corporation 427
Boston Gear Works, Inc. 403
Botwinik Bros., Inc..... 418
Boyar-Schultz Corp. 390
Bradford Machine Tool Co..... 374
Braun Gear Co. 402
Bridgeport Safety Emery Wheel Co., Inc. 394
Brown & Sharpe Mfg. Co., 210-211-411
Bryant Chucking Grinder Co., 67-261
Buhr Machine Tool Co. 378
Bullard Co. 135
Bunting Brass & Bronze Co. 325
Burke Machine Tool Co. 396
Butterfield Div. Union Twist Drill Co. 41

C

Carboloy Co., Inc. 219
Carborundum Co. 318-319
Card, S. W., Mfg. Co., Div. Union Twist Drill Co. 40
Carlton Machine Tool Co..... 381
Carpenter Steel Co. 86-87-413
Central Screw Co..... 249
Chambersburg Engineering Co... 359
Chandler Products Corp. 249
Chicago Perforating Co..... 419
Chiksan Company 356
Cincool Div., Cincinnati Milling Machine Co. 29
Cincinnati Bickford Tool Co. .. 215
Cincinnati Gear Co. 406
Cincinnati Mchry. & Supply Co. 418
Cincinnati Milling Machine Co. 8-9-10-11
Cincinnati Planer Co..... 330
Cincinnati Shaper Co..... 213
Cities Service Oil Co..... 258
Clark Controller Co..... 341
Classified Advertisements....416-419
Clearing Machine Corp., Front Cover
Cleveland Automatic Machine Co. 103
Cleveland Crane & Eng. Co. 363
Cleveland Pneumatic Tool Co... 308
Cleveland Punch & Shear Works Co. 367
Cleveland Tapping Machine Co. 378
Cleveland Twist Drill Co. 96-287
Cleveland Worm & Gear Co., Inside Back Cover
Climax Molybdenum Co. 253
Columbus Die, Tool & Machine Co. 407
Cone Automatic Machine Co., Inc..... 114
Cone Drive Division Michigan Tool Co. 237
Consolidated Machine Tool Corp. 23
Continental Screw Co. 249
Continental Tool Works 217
Cook, Asa S., Co. 392
Cooley Electric Mfg. Corp..... 422
Corbin Screw Div. 249
Cosa Corporation 133
Coulter, James, Machine Co..... 396
Cramp Brass & Iron Foundries Div. Baldwin Locomotive Works..... 94
Criterion Machine Works..... 354
Cross Company 371
Cumberland Steel Co. 98
Cuno Engineering Corp..... 266

D

Danly Machine Specialties, Inc..... 351
Davis & Thompson Co..... 396
Davis Keyseater Co. 398
DeLaval Separator Co..... 298
Delta Manufacturing Co..... 110
Denison Engineering Co. 312
Desmond-Stephan Mfg. Co. 386
Detroit Bevel Gear Co..... 400
Diefendorf Gear Corp. 404
DoAll Company..... 339
Dow Chemical Co. 99
Dumore Co..... 305
Durez Plastics & Chemicals, Inc.....228-229

E

Eastern Machinery Co..... 416
Eastern Machine Screw Corp. .. 419
Eberhardt-Denver Co..... 402
Electro Refractories & Alloy Corp..... 394
Elgin National Watch Co. 316
Elgin Tool Works 372-373
Elmes Engineering Works of American Steel Foundries..... 115
Elox Corporation 424
Errington Mechanical Laboratory..... 409
Etna Machine Co..... 366
Ettco Tool Co. 315
Ex-Cell-O Corporation 217

F

Fairfield Manufacturing Co..... 400
Farquhar, A. B., Co.....360-361
Farrel-Birmingham Co., Inc..... 430
Federal Bearings Co., Inc..... 306
Federal Machine & Welder Co. 342-343
Fellows Gear Shaper Co. 4-5
Firth-Sterling Steel Co. 27
Fitchburg Grinding Machine Corp..... 387
Foote-Bros. Gear & Mch. Corp. 279
Foote-Burt Company 65
Fosdick Machine Tool Co..... 379
Frasse, Peter A., & Co., Inc. 100
Frew Machine Co..... 395

G

Gairing Tool Co..... 329
Galland-Henning Mfg. Co..... 437
Gallmeyer & Livingston Co..... 392
Gammons-Hoagland Co. 419
Ganschow Gear Co..... 402
Gardner Machine Co..... 124
Garlock Packing Co..... 409
Gear Grinding Machine Co..... 350
Gear Specialties 45
General Electric Co. 107-127-275-283
Geometric Tool Co., Insert bet. 118-121
Giddings & Lewis Machine Tool Co.....18-19
Gisholt Machine Co. 221-223-241
Gits Bros. Mfg. Co. 410
Gleason Works 68
Gorton, George, Machine Co. 113-263
Goss & DeLeeuw Machine Co... 376
Graham Mfg. Co. 396
Grant Gear Works 402
Grant Mfg. & Machine Co..... 368
Gray Machine Co..... 366
Greenfield Tap & Die Corp., Insert bet. 118-121
Greenlee Bros. & Co., Insert bet. 68-83
Grinders & Fixtures, Inc..... 386
Grob Brothers..... 398
Gulf Oil Corporation..... 51
Gwilliam Co. 410

H

Hanna Engineering Works..... 299
Hannifin Mfg. Co. 321
Hanson Whitney Machine Co... 104
Hardinge Brothers, Inc. 60
Harper, H. M., Co. 249
Hartford Special Mchry. Co..... 398
Haskins, R. G., Co. 317
Heald Machine Co., Inside Front Cover
Heim Company 348
Hendey Machine Co..... 328
Henry & Wright Mfg. Co. 426
Hill Acme Co. 22
Hilliard Corporation..... 408
Hoefer Mfg. Co. 380
Holliday, W. J., & Co..... 270
Holo-Krome Screw Corp..... 282
Huther Bros. Saw Mfg. Co..... 398
Hydraulic Press Mfg. Co. 55
Hydraulic Products Co. 307
Hydropress, Inc. 364

I

Ideal Industries, Inc. 349
Ingersoll Milling Machine Co... 35
Ingersoll-Rand 276
International Screw Co. 249

J

Jack & Heintz Precision Industries, Inc. 280-281
Johnson Bronze Co. 88
Johnson, Carlyle, Machine Co... 278
Jones & Lamson Machine Co... 6-7
Jones & Laughlin Steel Corp. .. 247
Jones Machine Tool Works, Inc. 366

K

Kaufman Mfg. Co. 378
Kearney & Trecker Corp., 336-337-357
Kempsmith Machine Co. 54
Kennametal, Inc. 251
Kingsbury Machine Tool Corp. 111
Kropp Forge Co..... 412
Kux Machine Co. 395

L

L&J Press Corp..... 366
Lake Erie Engineering Corp..... 264
Lamson & Sessions Co..... 249
Landis Machine Co..... 2-3
Landis Tool Co.....14-15
Langelier Mfg. Co. 366-382
Lapointe Machine Tool Co..... 291
LeBlond, R. K., Mch. Tool Co.....300-301
Leeds & Northrup Co..... 138
Lehmann Machine Co. 131
Leland-Gifford Co. 56
Lempco Products, Inc. 420
Lepel High Frequency Laboratories, Inc..... 259
Lewis, B. C., Mfg. Co., Inc. 412
Lincoln Electric Co.....24-25
Lodge & Shipley Machine Tool Co. 128
Logan Engineering Co..... 265
Lord Manufacturing Co. 269
Lovejoy Flexible Coupling Co.. 408
Lovejoy Tool Co., Inc..... 346
Lucas Machine Tool Co..... 382
Luers, J. Milton 434

M

Madison-Kipp Corp. 322-323
Manufacturers Screw Products.. 249
Massachusetts Gear & Tool Co. 406
Master Electric Co..... 408
Materials Section.....83-102
Mattison Machine Works, Insert bet. 68-83
McCrosky Tool Corp..... 296
McGill Manufacturing Co., Inc., 290-419
McIntyre Company..... 303
Meisel Press Mfg. Co. 407
Merz Engineering Co..... 415
Miles Machinery Co. 416
Milford Rivet & Machine Co... 249
Moline Tool Co. 380
Monarch Machine Tool Co..... 66
Moore Special Tool Co., Inc..... 42
Morey Machinery Co., Inc..... 369
Morgan Engineering Co..... 408
Morse Chain Co..... 285
Morse Twist Drill & Machine Co. 254
Mummert-Dixon Co..... 382
Murray, D. J., Manufacturing Co. 374

N

National Lock Co..... 249
National Machinery Co..... 134
National Screw & Mfg. Co. 249
National Twist Drill & Tool Co. 136
Newark Gear Cutting Mch. Co. 369
New Britain Machine Co., New Britain-Gridley Mch. Div.... 225
New England Screw Co..... 249
New Jersey Gear & Mfg. Co..... 406
Niagara Machine & Tool Works 365
Nice Ball Bearing Co..... 267
Nichols, W. H., & Sons..... 26
Noble & Westbrook Mfg. Co..... 394
Norma-Hoffmann Bearings Corp..... 344
Norton Company 256-257

O

Oakite Products, Inc. 95
Ohio Crankshaft Co..... 53
Ohio Gear Company..... 401
Oilgear Company 331
Oliver Instrument Co..... 391
O'Neil-Irwin Mfg. Co. 434
Orange Roller Bearing Co., Inc. 335
Oster Manufacturing Co. 292
Otis Elevator Co..... 314
Ozalid Div., General Aniline & Film Corp..... 234

ALPHABETICAL INDEX OF ADVERTISERS—Continued

P

Pangborn Corp. 440
Parker-Kalon Corp. 108-249
Pawtucket Mfg. Co. 411
Pawtucket Screw Co. 249
Peck, Stow & Wilcox Co. 368
Perkins Mch. & Gear Co. 432
Pheoll Manufacturing Co. 249
Philadelphia Gear Works, Inc. .. 405
Phillips Screw Manufacturers 249
Pittsburgh Gear & Mch. Co. 406
Potter & Johnston Machine Co. 36-37
Pratt & Whitney Div. Niles-Bement-Pond Co. 297
Procunier Safety Chuck Co. 381
Production Machine Co. 386
Producto Machine Co. 369

Q

Quadriga Manufacturing Co. 414

R

R and L Tools 112
Reading Screw Co. 249
Reed-Prentice Corp. 58
Rehnberg-Jacobson Mfg. Co., Insert bet. 68-83
Reid Bros. Co., Inc. 390
Reliance Electric & Engineering Co. 262
Republic Steel Corp. 84-85
Robot Machinery Co. 431
Rockford Clutch .....Insert bet. 68-83
Rockford Machine Tool Co., Insert bet. 68-83
Rogers, John M., Tool Corp. 414
Rogers Machine Works, Inc. 358
Rotor Tool Co. 57
Rowbottom Machine Co. 395
Russell, Burdsall & Ward Bolt & Nut Co. 249
Rustless Iron & Steel Div., American Rolling Mill Co. 89-90-91
Ruthman Machinery Co. 121
Ryerson, Joseph T., & Son, Inc. 83

S

S. & H. Soft Hammer Products Co. 414
S & S Machine Works 369
Schatz Manufacturing Co. 347
Scherr, George, Co., Inc. 415
Schneible, Claude B., Co. 413
Scovill Mfg. Co. 249
Seneca Falls Machine Co. 289
Shakeproof, Inc. 249
Sheffield Corp. 32
Sheldon Machine Co., Inc. 376
Shell Oil Co., Inc. 242
Shepard Niles Crane & Hoist Corp. 429
Shore Instrument & Mfg. Co., Inc. 415
Sidney Machine Tool Co. 239
Sier-Bath Gear Co., Inc. 354
Simmons Machine Tool Corp. .. 417
Simonds Abrasive Co. 46
Simonds Saw & Steel Co. 59
Sinclair Refining Co. 102
Smit, J. K., & Sons, Inc. 393
Smith & Mills Co. 397
Sommer & Adams Co. 310
South Bend Lathe Works 302
Southington Hardware Mfg. Co. 249
Springfield Machine Tool Co. 126
Stahl Gear & Machine Co. 406
Standard Oil Co. (Indiana), Insert bet. 32-35
Standard Pressed Steel Co., 118-333-334
Stark Tool Company 374
Starrett, L. S., Co. 125
Steel Company of Canada, Ltd. 249
Steel Improvement & Forge Co. 93
Sterling Bolt Co. 249
Sticht, Herman, Co., Inc. 415
Stokerunit Corporation 384
Strand, N. A., & Co. 397
Stuart, D. A., Oil Co. 428
Sundstrand Machine Tool Co., Insert bet. 68-83
Sun Oil Co. 231
Sunnen Products Co. 116

T

Taft-Peirce Mfg. Co. 28
Taylor & Fenn Co. 380
Taylor Machine Co. 406
Taylor-Winfield Corp. 268
Texas Company 123
Thompson Grinder Co., Inc. 62-63
Threadwell Tap & Die Co. 61
Tide Water Associated Oil Co. .. 109
Timken Roller Bearing Co., 97—Back Cover
Titeflex, Inc. 38
Torrington Co., also Bantam Bearings Div. 320-368-438
Trico Fuse Mfg. Co. 410
Tuthill Pump Co. 132
Twin Disc Clutch Co. 294

U

Union Drawn Steel Div., Republic Steel Corp. 84-85
Union Manufacturing Co. 304
Union Twist Drill Co. 39-40-41
United States Products Co. 414
Universal Boring Machine Co. .. 382
Universal Engineering Co. 326
Used Machinery 416-419
U. S. Tool Company, Inc. 16-17

V

V & O Press Co., Inc. 368
Valvair Corporation 409
Van Keuren Co. 327
Van Norman Co. 12-13
Vanadium-Alloys Steel Co. 92
Veeder-Root, Inc. 338
Victory Engineering & Machine Works, Inc. 382
Viking Pump Co. 411
Vinco Corporation 47-48-49
Vitrified Wheel Co. 388

W

Wade Tool Co. 375
Waldes Kohinoor, Inc. 105
Walker, O. S., Co., Inc. 410
Walker-Turner Co., Inc. 345
Walls Sales Corp. 386
Waltham Machine Works 400
War Assets Administration, 271-272-273-274-332
Warner & Swasey Co. 30-31
Warren City Manufacturing Co. 293
Watson-Stillman Co. 288
Westinghouse Electric Corp. 117
Wheelock, Lovejoy & Co., Inc. .. 414
Whiting Corporation 233
Wiedemann Machine Co. 362
Williams, J. H., & Co. 313
Wilson, K. R. 352-353
Winter Brothers Co. 340
Wolverine Bolt Co. 249
Wood & Spencer Co. 421
Woodworth, N. A., Co. 309
Worcester Pressed Steel Co. 286
Wyzenbeek & Staff, Inc. 397

Y

Yoder Company 370

Z

Zeh & Hahnemann Co. 368

IN CLASSIFIED SECTION

Botwinik Brothers, Inc. 418
Cincinnati Machinery & Supply Co. 418
Dunlap, W. S. 419
Eastern Machinery Co. 416
Economy Co., Inc. 416
Haupt, Ray, Machine Shop 419
Marsh, Jas. P., Corp. 418
Miles Machinery Co. 416
Nolde & Horst Co. 419
Polack's Annoncebureau 419
Simmons Machine Tool Corp. .. 417
Welling, Charles H., & Co., Inc. 418

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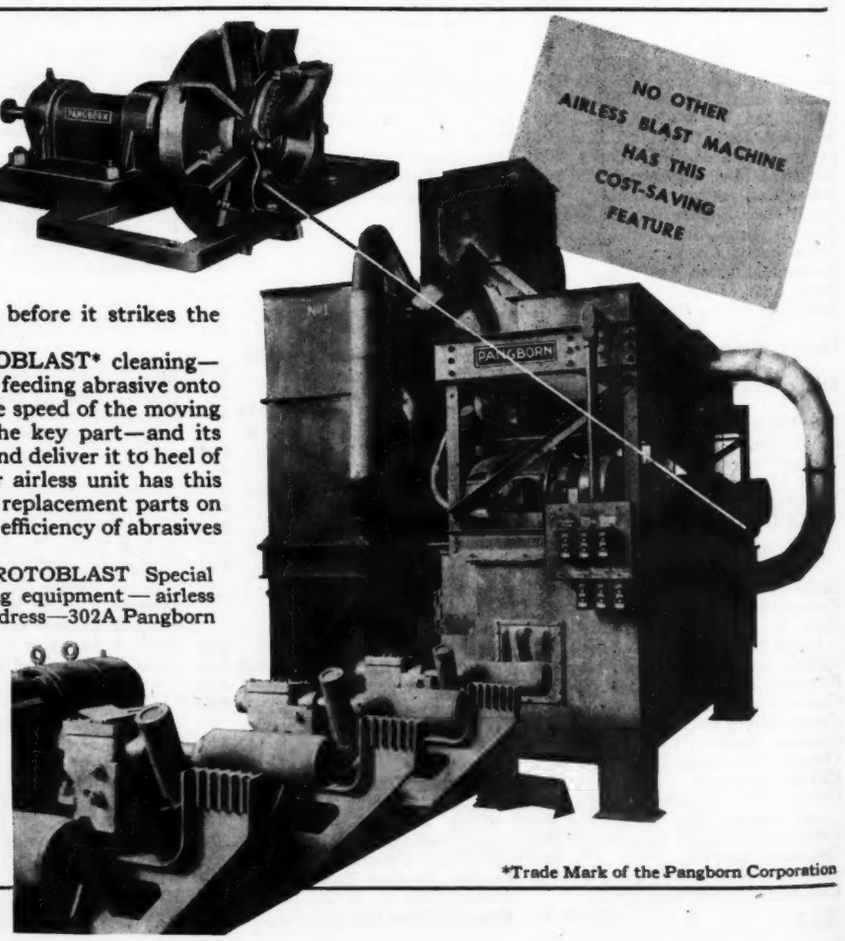

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